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CONTENTS OF VOLUME XLIX.

EDITORIAL NOTES.

	Page.
Changes in leadership	1
Progress in experiment station research in horticulture	101
A California view of agricultural college education	301
Some recent developments in forestry research	401
The World's Dairy Congress	601
The thirty-seventh convention of the Association of Land-grant colleges	701

STATION PUBLICATIONS ABSTRACTED.

ALABAMA STATION:
Circular 48 — 725

ALASKA STATIONS:
Report, 1921 — 413, 426, 434, 467, 491, 494

ARIZONA STATION:
Bulletin 96 — 641
Technical Bulletin 3 — 558
Technical Bulletin 4 — 620

Page.

ARKANSAS STATION:
Bulletin 182 297
Bulletin 183 253
Bulletin 184 364
Bulletin 185 554
Bulletin 186 590
Bulletin 187 809
Bulletin 188 897

CALIFORNIA STATION:
Bulletin 349 287
Bulletin 350 90
Bulletin 351 275
Bulletin 352 40
Bulletin 353 79
Bulletin 354 34
Bulletin 355 53
Bulletin 356 229
Bulletin 357 287
Bulletin 358 248
Bulletin 359 412
Bulletin 360 649
Bulletin 361 642
Bulletin 362 688
Bulletin 363 641
Circular 255 19
Circular 256 136
Circular 257 228
Circular 258 235
Circular 259 206
Outlines of Course of Instruction in Agricultural Nature Study for the Rural Schools of California, O. J. Kern 195
Technical Paper 1 319
Technical Paper 2 350
Technical Paper 3 318
Technical Paper 4 628
Technical Paper 5 650
Technical Paper 6 637

COLORADO STATION:
Bulletin 279 82
Bulletin 280 51
Bulletin 281 86
Bulletin 282 87
Bulletin 283 137
Bulletin 284 588
Bulletin 285 530
Bulletin 286 513
Thirty-fifth Annual Report, 1922 412, 433, 441, 445, 450, 476, 494

CONNECTICUT STATE STATION:
Bulletin 241 124
Bulletin 242 233
Bulletin 243 (Report, 1922) 696
Bulletin 244 534
Bulletin 245 534

CONNECTICUT STATE STATION—Continued. Page.
Bulletin 246 556
Bulletin Immediate Information 17 660
Bulletin Immediate Information 18 655
Bulletin Immediate Information 24 742
Tobacco Substation Bulletin 1 647
Tobacco Substation Bulletin 2 647
Tobacco Substation Bulletin 3 633
CONNECTICUT STORRS STATION:
Bulletin 110 56
Bulletin 111 575
Bulletin 112 784
Bulletin 113 776
DELAWARE STATION:
Bulletin 134 9
FLORIDA STATION:
Report, 1922 823, 838, 847, 873, 874, 898
GEORGIA STATION:
Bulletin 141 346
Thirty-fifth Annual Report, 1922 516, 524, 531, 537, 541, 573, 578, 598
GUAM STATION:
Report, 1921 413, 414, 426, 435, 464, 471, 480, 494
HAWAII STATION:
Bulletin 47 411
Bulletin 48 572
Bulletin 49 641
IDAHO STATION:
Bulletin 131 (Annual Report, 1922) 732, 736, 739, 745, 751, 756, 772, 774, 777, 778, 798
Bulletin 132 88
Circular 30 (Biennial Report, 1921–22) 213, 241, 268, 273, 298
ILLINOIS STATION:
Bulletin 242 343
Bulletin 242, abstract 541
Bulletin 243 330
Bulletin 244 576
Circular 266 338
Circular 267 494
Circular 268 431
Circular 269 481
Circular 270 450
Circular 271 787
Thirty-fifth Annual Report, 1922 315, 329, 336, 343, 365, 368, 375, 380, 395
INDIANA STATION:
Bulletin 265 267
Bulletin 266 636
Bulletin 267 754
Bulletin 268 771
Bulletin 269 727
Circular 108 273
Circular 109 257
Circular 110 584

INDIANA STATION—Continued. Page.
Circular 111 878
Circular 112 830
Thirty-fifth Annual Report, 1922 531, 537, 540, 545, 548, 571, 573, 579, 580, 591, 592, 599

IOWA STATION:
Bulletin 208 (abridged edition) 572
Bulletin 210 571
Bulletin 211 293
Bulletin 212 578
Bulletin 213 724
Bulletin 214 793
Bulletin 215 870
Research Bulletin 74 376
Research Bulletin 75 318
Research Bulletin 76 722
Circular 82 210
Circular 83 373
Circular 84 230
Circular 85 572
Circular 86 853
Soil Survey Reports 25–28 810
Annual Report, 1922 723, 731, 732, 736, 740, 746, 757, 772, 773, 774, 777, 779, 781, 788, 798

KANSAS STATION:
Technical Bulletin 10 680
Inspection Circular 12 518
Biennial Report, 1921–22 414, 427, 443, 453, 464, 466, 470, 472, 473, 477, 489, 495

KENTUCKY STATION:
Bulletin 244 164
Bulletin 246 293
Bulletin 247 892
Circular 29 131
Circular 30 272
Regulatory Series No. 1 275
Regulatory Series No. 2 276
Regulatory Series No. 3 276
Thirty-fifth Annual Report, 1922, pt. 1 509, 516 520, 524, 531, 541, 543, 544, 549, 571, 573, 574, 580, 586, 592, 599

LOUISIANA STATIONS:
Bulletin 185 52
Bulletin 186 283
Bulletin 187 271
Bulletin 188 855
Thirty-fourth Annual Report 824, 848, 881, 890, 898

MAINE STATION:
Bulletin 306 174
Bulletin 307 139
Bulletin 308 657
Official Inspection 105 218
Official Inspection 106 232, 233

MARYLAND STATION:
Page.
Bulletin 251 ... 332
Bulletin 252 ... 354
Bulletin 253 ... 334
Bulletin 254 ... 832
Thirty-fifth Annual Report, 1922 ... 599

MASSACHUSETTS STATION:
Meteorological Bulletins 411–412, March–April, 1923 ... 208
Meteorological Bulletins 413–414, May–June, 1923 ... 509
Meteorological Bulletins 415–416, July–August, 1923 ... 719
Circular 70 ... 495

MICHIGAN STATION:
Special Bulletin 121 ... 237
Circulars 55–60 ... 215
Quarterly Bulletin—
Volume 5—
No. 3, February, 1923 ... 16, 19, 31, 32, 35, 37, 43, 45, 48, 53, 80, 84, 85, 97
No. 4, May, 1923 ... 415, 419, 431, 432, 438, 439, 443, 446, 469, 478, 482, 483, 487, 489, 495
Volume 6—
No. 1, August, 1923 ... 841, 844, 846, 878, 884, 889, 898

MINNESOTA STATION:
Bulletin 201 ... 488
Bulletin 202 ... 490
Bulletin 203 ... 439
Bulletin 204 ... 431
Technical Bulletin 11 ... 747
Technical Bulletin 12 ... 758

MISSISSIPPI STATION:
Bulletin 211 ... 222
Bulletin 212 ... 226
Bulletin 213 ... 222, 234, 298
Bulletin 214 ... 267
Bulletin 215 ... 225
Bulletin 216 ... 495
Circular 46 ... 330
Circular 47 ... 32
Circular 48 ... 869
Thirty-fifth Annual Report, 1922 ... 414, 420, 428, 441, 454, 465, 469, 471, 488, 495

MISSOURI STATION:
Bulletin 198 ... 229
Bulletin 199 ... 293
Bulletin 200 ... 23
Bulletin 201 ... 79
Research Bulletin 57 ... 640
Circular 109 ... 253
Circular 110 ... 288
Circular 111 ... 574
Circular 112 ... 555

Page.

MONTANA STATION:
Bulletin 150 251
Bulletin 151 485
Bulletin 152 430
Bulletin 153 430
Bulletin 154 852
Bulletin 155 874
Bulletin 156 833
Bulletin 157 832
Circular 108 231
Circular 109 254
Circular 110 480
Circular 111 471
Circular 112 450
Circular 113 432
Circular 114 831
Twenty-eighth Annual Report, 1921 116, 129, 136, 146, 148, 152, 166, 167, 168, 170, 171, 172, 178, 184, 188, 195

NEBRASKA STATION:
Bulletin 185 189
Bulletin 186 46
Bulletin 187 292
Bulletin 188 225
Bulletin 189 340
Bulletin 190 328
Bulletin 191 595
Bulletin 192 527
Bulletin 193 527
Bulletin 194 670
Research Bulletin 23 147
Circular 20 658
Thirty-sixth Annual Report, 1922 732, 751, 752, 772, 773, 774, 775, 777, 782, 798

NEVADA STATION:
Bulletin 104 582
Bulletin 105 583
Annual Report, 1922 696

NEW HAMPSHIRE STATION:
Bulletin 208 (Report, 1922) 311, 323, 327, 328, 336, 341, 345, 347, 349, 350, 351, 370, 395
Technical Bulletin 22 651
Technical Bulletin 23 741
Technical Bulletin 24 853

NEW JERSEY STATIONS:
Bulletin 372 233
Bulletin 373 356
Bulletin 376 325
Bulletin 377 635
Bulletin 378 353
Bulletin 379 349
Bulletin 382 422
Circular 146 148
Circular 147–151 138
Circular 152 388

NEW JERSEY STATIONS—Continued.
Hints to Poultrymen, vol. 11— Page.
No. 6, March, 1923 172
No. 7, April, 1923 273
No. 8, May, 1923 273
No. 9, June, 1923 576
No. 10, July, 1923 794
No. 11, August, 1923 777
NEW MEXICO STATION:
Bulletin 128 868
Bulletin 135 154
Bulletin 136 886
Thirty-third Annual Report, 1922 513, 514, 515, 517, 525, 532, 546, 548, 553, 574, 599
NEW YORK CORNELL STATION:
Bulletin 414 690
Bulletin 415 637
Bulletin 416 92
Bulletin 417 355
Bulletin 418 475
Bulletin 419 639
Memoir 58 154
Memoir 59 338
Memoir 60 32
Memoir 61 117
Memoir 62 28
Memoir 63 235
Memoir 64 577
Memoir 65 520
Memoir 66 712
Memoir 67 854
NEW YORK STATE STATION:
Bulletin 495 340
Bulletin 496 380
Bulletin 497 338
Bulletin 498 340
Bulletin 499 325
Bulletin 500 339
Bulletin 500 (popular edition) 742
Bulletin 501 551
Bulletin 502 552
Bulletin 503 534, 535
Technical Bulletin 92 309
Technical Bulletin 93 731
Circular 59 97
Circular 60 97
Circular 61 97
Circular 62 97
Circular 63 39
Circular 64 49, 53, 97
Circular 65 52
Circular 66 535
Circular 67 546
A Few Facts About the Station and Its Work 798
Forty-first Annual Report, 1922 12, 38, 97

NORTH CAROLINA STATION:
Farmers' Market Bulletin, vol. 10— Page.
No. 61, April, 1923 294
No. 62, May, 1923 489
No. 63, August, 1923 793
Forty-fifth Annual Report, 1922 724, 733, 747, 757, 772, 773, 775, 780, 787, 798

NORTH DAKOTA STATION:
Bulletin 166 343

OHIO STATION:
Bulletin 361 724, 733, 773, 792, 798
Bulletin 362 (Forty-first Annual Report, 1922) 308, 323, 329, 337, 342, 346, 350, 352, 370, 372, 373, 375, 376, 388, 395
Monthly Bulletin, vol. 8—
No. 1–2, January–February, 1923 234, 235, 259, 269, 273, 298
No. 3–4, March–April, 1923 333, 338, 339, 340, 395
No. 5–6, May–June, 1923 625, 632, 648, 656, 673, 676, 696
No. 7–8, July–August, 1923 737, 738, 798

OKLAHOMA STATION:
Bulletin 140 434
Bulletin 141 432
Bulletin 142 467
Bulletin 143 420
Bulletin 144 468
Bulletin 145 433
Circular 51 586
Circular 52 542
Circular 53 558
Circular 54 529
Thirty-first Annual Report, 1922 414, 428, 445, 450, 459, 464, 470, 475, 477, 495

OREGON STATION:
Bulletin 196 373
Circular 34 133
Circular 35 156
Circular 36 157
Circular 37 255
Circular 38 254
Circular 39 357
Circular 40 388
Circular 41 579
Circular 42 547, 555
Circular 43 535
Circular 44 510
Circular 45 546, 555
Circular 46 530
Circular 47 588
Circular 48 742
Circular 49 755
Biennial Report, 1921–22 507, 510, 514, 525, 532, 533, 538, 541, 546, 549, 572, 578, 579, 581, 599

PENNSYLVANIA STATION:
Page.
Bulletin 176 (Annual Report, 1922) ---- 210, 214, 215, 222, 232, 251, 268, 269, 271, 274, 277, 298
Bulletin 177 ---- 348
Bulletin 178 ---- 472
Bulletin 179 ---- 737

PORTO RICO DEPARTMENT OF AGRICULTURE AND LABOR STATION:
Bulletin 30 ---- 35
Bulletin 31 (Spanish edition) ---- 23
Circular 23 (Spanish edition) ---- 35
Circular 53 (Spanish edition) ---- 52
Circular 59 (Spanish edition) ---- 52
Circular 60 (Spanish edition) ---- 56
Circular 64 (Spanish edition) ---- 252
Circular 65 (Spanish edition) ---- 252
Circular 66 (Spanish edition) ---- 270
Circular 69 (Spanish edition) ---- 279
Circular 70 (Spanish edition) ---- 283
Circular 72 ---- 341
Circular 74 (Spanish edition) ---- 324
Circular 84 (Spanish edition) ---- 379
Annual Report, 1922 (English and Spanish edition) ---- 539, 544, 549, 555, 586, 599

PORTO RICO STATION:
Bulletin 28 (Spanish edition) ---- 150

RHODE ISLAND STATION:
Bulletin 191 ---- 81
Bulletin 192 ---- 91
Bulletin 193 (Thirty-fifth Annual Report, 1922) ---- 510, 512, 526, 533, 544, 575, 599
Annual Feed Circular, 1923 ---- 370

SOUTH DAKOTA STATION:
Bulletin 200 ---- 635
Bulletin 201 ---- 635
Bulletin 202 ---- 654
Annual Report, 1922 ---- 510, 527, 533, 549, 579, 599

TEXAS STATION:
Bulletin 304 ---- 320
Thirty-fourth Annual Report, 1921 ---- 428, 435, 442, 467, 469, 470, 481, 495

VIRGIN ISLANDS STATION:
Bulletin 3 ---- 352
Bulletin 4 ---- 654

VIRGINIA STATION:
Bulletin 231 ---- 134

VIRGINIA TRUCK STATION:
Bulletin 41 ---- 233
Bulletin 42 ---- 347

Page.

WASHINGTON COLLEGE STATION:
Bulletin 174 ---- 452
Bulletin 175 (Thirty-second Annual Report, 1922) ---- 209, 214, 215, 223, 232, 241, 245, 247, 248, 251, 265, 268, 270, 275, 278, 284, 291, 298.
Bulletin 176 ---- 211
Bulletin 177 ---- 755
Popular Bulletin 123 ---- 689

WESTERN WASHINGTON STATION:
Bimonthly Bulletin—
Volume 10—
No. 6, March, 1923 ---- 71, 72, 87, 97
Volume 11—
No. 1, May, 1923 ---- 373, 375, 395
No. 2, July, 1923 ---- 576, 599
No. 3, September, 1923 ---- 845, 850, 874, 884, 898

WISCONSIN STATION:
Bulletin 349 ---- 31
Bulletin 350 ---- 167
Bulletin 351 ---- 285
Bulletin 352 (Annual Report, 1922) ---- 610, 611, 620, 622, 626, 629, 630, 643, 653, 660, 664, 666, 668, 669, 672, 675, 676, 677, 679, 681, 684, 686, 687, 688, 690, 696.
Bulletin 353 ---- 689
Bulletin 354 ---- 639
Bulletin 355 ---- 760
Research Bulletin 56 ---- 140

WYOMING STATION:
Bulletin 134 ---- 867
Circular 19 ---- 337
Thirty-second Annual Report, 1922 ---- 413, 429, 466, 467, 470, 476, 495

UNITED STATES DEPARTMENT OF AGRICULTURE PUBLICATIONS ABSTRACTED.

Bulletin 973, Milk Plant Operation, C. E. Clement ---- 377
Bulletin 1004, Use of Water by Spring Wheat on the Great Plains, J. S. Cole and O. R. Mathews ---- 134
Bulletin 1074, Classification of American Wheat Varieties, J. A. Clark, J. H. Martin, and C. R. Ball ---- 634
Bulletin 1105, Natural Reproduction of Western Yellow Pine in the Southwest, G. A. Pearson ---- 641
Bulletin 1119, Lumber Cut of the United States, 1870–1920, R. V. Reynolds and A. H. Pierson ---- 239
Bulletin 1126, The Effect of Borax on the Growth and Yield of Crops, J. J. Skinner, B. E. Brown, and F. R. Reid ---- 324
Bulletin 1128, Decays and Discolorations in Airplane Woods, J. S. Boyce ---- 351
Bulletin 1134, Self-fertilization and Cross-fertilization in Pima Cotton, T. H. Kearney ---- 226
Bulletin 1135, Spinning Tests of Cotton Compressed to Different Densities, W. R. Meadows and W. G. Blair ---- 331
Bulletin 1136, Kiln Drying Handbook, R. Thelen ---- 386

Page.
Bulletin 1137, Symptoms of Wheat Rosette Compared with Those Produced by Certain Insects, H. H. McKinney and W. H. Larrimer 344
Bulletin 1138, Vitamin B in the Edible Tissues of the Ox, Sheep, and Hog.—I, Vitamin B in the Voluntary Muscle. II, Vitamin B in the Edible Viscera, R. Hoagland 63
Bulletin 1139, Storage of Water in Soil and Its Utilization by Spring Wheat, O. R. Mathews and E. C. Chilcott 418
Bulletin 1140, The Deterioration of Felled Western Yellow Pine on Insect Control Projects, J. S. Boyce 43
Bulletin 1141, Evaporation of Fruits, J. S. Caldwell 411
Bulletin 1142, The Barrier Factors in Gipsy Moth Tree-banding Material, M. T. Smulyan 253
Bulletin 1143, Dry Land Pasture Crops for Hogs at Huntley, Mont., A. E. Seamans 371
Bulletin 1144, Cost of Milk Production on 48 Wisconsin Farms, S. W. Mendum 88
Bulletin 1145, Migration Records from Wild Ducks and Other Birds Banded in the Salt Lake Valley, Utah, A. Wetmore 351
Bulletin 1146, The Influence of Copper Sprays on the Yield and Consumption of Irish Potato Tubers, F. C. Cook 247
Bulletin 1147, Chemical, Physical, and Insecticidal Properties of Arsenicals, F. C. Cook and N. E. McIndoo 448
Bulletin 1148, Comparative Spinning Tests of Superior Varieties of Cotton (Grown under Weevil Conditions in the Southeastern States; Crop of 1921), W. R. Meadows and W. G. Blair 33
Bulletin 1149, Absorption and Retention of Hydrocyanic Acid by Fumigated Food Products, E. L. Griffin, I. E. Neifert, N. Perrine, and A. B. Duckett 456
Bulletin 1151, Silver Fox Farming, F. G. Ashbrook 471
Bulletin 1152, Soy and Related Fermentations, M. B. Church 311
Bulletin 1153, Boll Weevil Cotton in Texas, O. F. Cook 432
Bulletin 1154, Feeding Habits of the Japanese Beetle Which Influence Its Control, L. B. Smith 454
Bulletin 1155, Rice Experiments at the Biggs Rice Field Station in California, J. W. Jones 433
Bulletin 1156, Investigations of Potato Wart, F. Weiss, C. R. Orton, and R. E. Hartman 443, 444
Bulletin 1157, Influence of Spacing on Productivity in Single-ear and Prolific Types of Corn, E. B. Brown and H. S. Garrison 431
Bulletin 1158, Production of Sirup from Sweet Potatoes, H. C. Gore, H. C. Reese, and J. O. Reed 506
Bulletin 1159, Coloring Satsuma Oranges in Alabama, R. C. Wright 743
Bulletin 1160, Studies on Contact Insecticides, C. H. Richardson and C. R. Smith 550
Bulletin 1161, Effect of Composition on the Palatability of Ice Cream, O. E. Williams and G. R. Campbell 579
Bulletin 1163, A Study of Decay in Douglas Fir in the Pacific Northwest, J. S. Boyce 755
Bulletin 1165, Report on Bird Censuses in the United States, 1916 to 1920, M. T. Cooke 652
Bulletin 1166, Apple By-products as Stock Foods, G. P. Walton and G. L. Bidwell 675

Page.

Bulletin 1167, Cultivation of the True Yams in the Gulf Region, R. A. Young ---- 738
Bulletin 1168, Wearing Qualities of Shoe Leathers, F. P. Veitch, R. W. Frey, and I. D. Clarke ---- 717
Bulletin 1169, Further Studies with Paradichlorobenzene for Peach Borer Control, with Special Reference to Its Use on Young Peach Trees, O. I. Snapp and C. H. Alden ---- 851
Bulletin 1170, Effects of Different Systems and Intensities of Grazing upon the Native Vegetation at the Northern Great Plains Field Station, J. T. Sarvis ---- 865
Bulletin 1171, The Manufacture of Camembert Cheese, K. J. Matheson and S. A. Hall ---- 878
Bulletin 1172, Cereal Experiments at Chico, Calif., V. H. Florell ---- 825
Bulletin 1173, Experiments in Wheat Production on the Dry Lands of the Western United States, D. E. Stephens, M. A. McCall, and A. F. Bracken ---- 828
Bulletin 1174, Hungarian Vetch, R. McKee and H. A. Schoth ---- 828
Bulletin 1175, Grain Sorghum Experiments at the Woodward Field Station in Oklahoma, J. B. Sieglinger ---- 827
Farmers' Bulletin 1236, Corn and Its Uses as Food ---- 158
Farmers' Bulletin 1244, Diseases, Ailments, and Abnormal Conditions of Swine, T. P. White ---- 787
Farmers' Bulletin 1289, Distribution of Types of Farming in the United States, W. J. Spillman ---- 592
Farmers' Bulletin 1302, How to Get Rid of Rats, J. Silver ---- 351
Farmers' Bulletin 1303, The Club Wheats, J. A. Clark and J. H. Martin ---- 335
Farmers' Bulletin 1304, The Durum Wheats, J. A. Clark and J. H. Martin 37
Farmers' Bulletin 1306, Insect Enemies of Chrysanthemums, C. A. Weigel 152
Farmers' Bulletin 1312, Tree Planting in the Great Plains Region, F. R. Johnson and F. E. Cobb ---- 141
Farmers' Bulletin 1313, Good Proportions in the Diet, C. L. Hunt ---- 158
Farmers' Bulletin 1314, Motor Trucks on Corn Belt Farms, H. R. Tolley and L. M. Church ---- 185
Farmers' Bulletin 1315, Cleaning Milking Machines, L. H. Burgwald ---- 175
Farmers' Bulletin 1316, Marketing the Early Potato Crop, G. B. Fiske and P. Froehlich ---- 489
Farmers' Bulletin 1317, Marketing Main-crop Potatoes, W. A. Sherman, G. B. Fiske, and O. D. Miller ---- 793
Farmers' Bulletin 1318, Greenhouse Construction and Heating, J. H. Beattie ---- 487
Farmers' Bulletin 1319, Cotton-dusting Machinery, E. Johnson, S. T. Howard, and B. R. Coad ---- 590
Farmers' Bulletin 1320, The Production of Cucumbers in Greenhouses, J. H. Beattie ---- 436
Farmers' Bulletin 1321, Fumigation of Citrus Trees for Control of Insect Pests, R. S. Woglum ---- 849
Farmers' Bulletin 1322, The Striped Cucumber Beetle and How to Control It, F. H. Chittenden ---- 454
Farmers' Bulletin 1323, The Wheat Strawworm and Its Control, W. J. Phillips and F. W. Poos ---- 558
Farmers' Bulletin 1324, Lamb and Mutton and Their Use in the Diet ---- 660
Farmers' Bulletin 1325, Rural Planning—The Social Aspects, W. C. Nason ---- 694

Page.
Farmers' Bulletin 1327, Canaries: Their Care and Management, A. Wetmore 675
Farmers' Bulletin 1329, The Boll Weevil Problem, W. D. Hunter and B. R. Coad 659
Farmers' Bulletin 1330, Parasites and Parasitic Diseases of Sheep, M. C. Hall 786
Farmers' Bulletin 1331, Back-yard Poultry Keeping, R. R. Slocum 777
Farmers' Bulletin 1332, Seed Potatoes and How to Produce Them, W. Stuart 736
Farmers' Bulletin 1333, Pruning Citrus Trees in the Southwest, A. D. Shamel, C. S. Pomeroy, and R. E. Caryl 742
Farmers' Bulletin 1334, Home Tanning of Leather and Small Fur Skins, R. W. Frey, I. D. Clarke, and F. P. Veitch 717
Farmers' Bulletin 1335, Controlling the Gipsy Moth and the Brown-tail Moth, A. F. Burgess 852
Farmers' Bulletin 1336, Feeding and Management of Dairy Calves and Young Dairy Stock, W. K. Brainerd and H. P. Davis 875
Farmers' Bulletin 1337, Diseases of Poultry, B. A. Gallagher 885
Farmers' Bulletin 1338, Tomatoes as a Truck Crop, W. R. Beattie 833
Statistical Bulletin 1, Cold Storage Holdings 892
Circular 250, Educational Milk-for-health Campaigns, J. M. Hoover 493
Circular 251, Federal Legislation, Regulations, and Rulings Affecting Land-grant Colleges and Experiment Stations 195
Circular 254, Homemade Apple and Citrus Pectin Extracts and Their Use in Jelly Making, M. C. Denton, R. Johnstin, and F. W. Yeatman 114
Circular 255, Status and Results of Boys' and Girls' Club Work, Northern and Western State, 1921, G. E. Farrell and G. L. Warren 394
Circular 258, Turpentine and Rosin: Distribution of the World's Production, Trade, and Consumption, V. E. Grotlisch 143
Circular 261, The Purpose of Bird Censuses and How to Take Them, M. T. Cooke 151
Circular 262, Length of the Dormancy Period of the Sugar Beet Nematode in Utah, G. Thorne 47
Circular 263, Preliminary Report on Control of San José Scale with Lubricating-oil Emulsion, A. J. Ackerman 354
Circular 264, Frost Resistance in Flax, R. L. Davis 332
Circular 265, Arbor Day 641
Circular 266, Dispersion of the Boll Weevil in 1922, F. F. Bondy, R. C. Gaines, W. B. Williams, and M. T. Young 156
Circular 267, The Work of the Newlands Reclamation Project Experiment Farm in 1920 and 1921, F. B. Headley and E. W. Knight 621, 630, 636, 696
Circular 268, Kill the Common Barberry with Chemicals, N. F. Thompson 146
Circular 269, Barberry Eradication Prevents Black Rust in Western Europe, E. C. Stakman 146
Circular 271, Grounding Cotton Gins to Prevent Fires, H. E. Roethe 590
Circular 272, Woolly-pod Milkweed: A Dangerous Stock-poisoning Plant, C. D. Marsh and A. B. Clawson 583
Circular 273, Flag Smut of Wheat, W. H. Tisdale, G. H. Dungan, and C. E. Leighty 841
Circular 274, Dusting for the Cotton Boll Weevil, B. R. Coad and T. P. Cassidy 558

Page.

Circular 275, The Work of the Huntley Reclamation Project Experiment Farm in 1921, D. Hansen 824, 872, 875, 898
Circular 276, Inspection of Milk Supplies, E. Kelly and C. S. Leete 878
Miscellaneous Circular 3, The Relation of Agricultural Education to Farm Organizations, C. W. Pugsley 392
Miscellaneous Circular 4, List of Workers in Subjects Pertaining to Agriculture, 1922–23, pt, 2: State Agricultural Colleges and Experiment Stations 492
Miscellaneous Circular 5, The Bandelier National Monument, Santa Fe National Forest, N. Mex 342
Miscellaneous Circular 6, Crop and Live Stock Estimates, 1910–1922 391
Annual Reports, 1922 395
Cooperative Extension Work, 1921 494
Official Record, vol. 2, No. 9, February 28, 1923 33
Weather, Crops, and Markets:
Volume 3—
No. 9, March 3, 1923 90
No. 10, March 10, 1923 90
No. 11, March 17, 1923 90
No. 12, March 24, 1923 90
No. 13, March 31, 1923 90
No. 14, April 7, 1923 294
No. 15, April 14, 1923 294
No. 16, April 21, 1923 294
No. 17, April 28, 1923 294
No. 18, May 5, 1923 390
No. 19, May 12, 1923 390
No. 20, May 19, 1923 390
No. 21, May 26, 1923 390
No. 22, June 2, 1923 594
No. 23, June 9, 1923 594
No. 24, June 16, 1923 594
No. 25, June 23, 1923 594
No. 26, June 30, 1923 594
Volume 4:
No. 1, July 7, 1923 693
No. 2, July 14, 1923 693
No. 3, July 21, 1923 693
No. 4, July 28, 1923 693
No. 5, August 4, 1923 793
No. 6–7, August 11, 18, 1923 793
No. 8, August 25, 1923 793
No. 9, September 1, 1923 892
No. 10, September 8, 1923 892
No. 11, September 15, 1923 892
No. 12, September 22, 1923 892
No. 13, September 29, 1923 892
Work and Expenditures of the Agricultural Experiment Stations, 1921, E. W. Allen, E. R. Flint, and J. I. Schulte 897
Yearbook, 1922 ..... 334, 341, 373, 389, 390, 391, 395

OFFICE OF FARM MANAGEMENT:
Atlas of American Agriculture: II, Climate.—A, Precipitation and Humidity, J. B. Kincer 313

LIBRARY:
Page.
Bibliographical Contributions No. 5, Index to Some Sources of Current Prices, compiled by E. T. Shively ---- 794
BUREAU OF AGRICULTURAL ECONOMICS:
Foreign Section Report 28, The Agricultural Situation in Austria, L. G. Michael ---- 93
Summary of Statistics of Agricultural Exports and Imports to Be Considered in Adjusting Agricultural Production to Foreign Demand ---- 391
BUREAU OF ANIMAL INDUSTRY:
Order 211 (revised), Regulations Governing the Meat Inspection of the United States Department of Agriculture ---- 782
BUREAU OF BIOLOGICAL SURVEY:
North American Fauna 46, A Biological Survey of the Pribilof Islands, Alaska, E. A. Preble, W. L. McAtee et al ---- 652
FOREST SERVICE:
Trail Construction on the National Forests ---- 790
Trespass on National Forests of Forest Service District 1, P. J. O'Brien ---- 537
PACKERS AND STOCKYARDS ADMINISTRATION:
Great Britain and the World's Live Stock Industry.—I, Beef and Mutton. II, The Vestey Interests, C. J. Brand ---- 892
BUREAU OF PLANT INDUSTRY:
Inventory of Seeds and Plants Imported, April 1 to May 31, 1920 (No. 63) ---- 128
Inventory of Seeds and Plants Imported, June 1 to September 30, 1920 (No. 64) ---- 426
Inventory of Seeds and Plants Imported, October 1 to December 31, 1920 (No. 65) ---- 426
Inventory of Seeds and Plants Imported, January 1 to March 31, 1921 (No. 66) ---- 523
BUREAU OF SOILS:
Field Operations, 1919—
Soil Survey in California, Shasta Valley Area ---- 415
Soil Survey in Kansas, Leavenworth County ---- 416
Soil Survey in New Jersey, Bernardsville Area ---- 720
Soil Survey in New York, Wayne County ---- 721
Soil Survey in Oregon, Josephine County ---- 721
Soil Survey in Oregon, Multnomah County ---- 316
Soil Survey in Texas, Red River County ---- 416
Field Operations, 1920—
Soil Survey in Alabama, Houston County ---- 415
Soil Survey in Iowa, Boone County ---- 415
Soil Survey in Iowa, Emmet County ---- 719
Soil Survey in Iowa, Mills County ---- 315
Soil Survey in Mississippi, Choctaw County ---- 416
Soil Survey in Mississippi, Smith County ---- 720
Soil Survey in Nebraska, Madison County ---- 416
Soil Survey in North Carolina, Guilford County ---- 315
Soil Survey in Texas, Erath County ---- 721
Field Operations, 1921—
Soil Survey in Florida, Duval County ---- 719
Soil Survey in Indiana, Adams County ---- 511
Soil Survey in Michigan, St. Joseph County ---- 720

STATES RELATIONS SERVICE: Page.
A Classified List of Projects Carried on by the Agricultural Experiment Stations, 1922–23, E. R. Flint ---- 898
WEATHER BUREAU:
The Weather Bureau, H. E. Williams, revised by E. B. Calvert ---- 718
Monthly Weather Review—
Volume 51—
No. 1, January, 1923 ---- 207
No. 2, February, 1923 ---- 207
No. 3, March, 1923 ---- 508, 509
No. 4, April, 1923 ---- 508, 509
No. 5, May, 1923 ---- 718, 719
No. 6, June, 1923 ---- 718, 719
Supplement 19, 1923 ---- 314, 337
Climatological Data—
Volume 9—
No. 13, 1922 ---- 412
Volume 10—
Nos. 1–2, January–February, 1923 ---- 413
Nos. 3–4, March–April, 1923 ---- 615
Nos. 5–6, May–June, 1923 ---- 809
Report, 1922 ---- 508

EXPERIMENT STATION RECORD.

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The close of the fiscal year 1923 was marked by several changes of such significance and interest as to merit notice. It was the occasion of the retirement of three persons long and prominently identified with leading agricultural institutions, who had played an active part in the affairs of the American agricultural colleges and experiment stations. It also witnessed changes in organization and relationship of two institutions.

Those to retire from the positions which they have held with such credit to themselves and advantage to their constituents were Dr. A. C. True, director of the States Relations Service, Dr. E. H. Jenkins, director of the Connecticut experiment stations, and Dr. Thomas F. Hunt, dean of the college of agriculture in the University of California. One of these has had the longest period of service of any person connected with the American stations, dating back almost to the beginning of the earliest station; another has served as director of a similar institution nearly as old, located at the opposite side of the continent; while the third has been a leader and wise counsellor from nearly the beginning of the Federal system of stations, whose influence has had much to do with shaping its course of development. These changes, added to those of two years ago when two other pioneer directors entered into retirement, suggest the march of time in the life of the stations, and the fact that already they are coming largely under the direction of a new generation. The changes in organization and relationship apply to the States Relations Service in the U. S. Department of Agriculture and the New York State Experiment Station.

It is noteworthy that the institutions concerned in these events all rank among the oldest in this country in their association with agricultural education and research. In Connecticut, California, and New York, the history goes back to the pioneer days of agricultural experimentation, the first two pointing to the beginning of operations in 1875 and the third to only a few years later. Cornell started a station in 1879 and the State station at Geneva was established in 1882.

The States Relations Service, although existing under that name only since 1915, goes back through its predecessor to the beginning

of the station system under Federal aid. The Office of Experiment Stations was provided for in the original Hatch Act, although not formally designated, and when the States Relations Service was developed the Office continued as the division charged with the interests of the stations and representing the Department in its relations with them. Under the reorganization which resolves the Service into a number of constituent parts, as described in the March issue of the *Record*, the Office again becomes a separate unit in the Department and will continue to function in the same capacity as formerly.

In New York State the two experiment stations at Geneva and at the agricultural college at Ithaca which have heretofore existed as separate institutions were united under a single board and a single director. This is the result of legislation enacted by the last State Legislature, which received the harmonious support of the administrative officers of both stations and suggestions from them regarding the details of the plan. The State station at Geneva is continued but henceforth is to be under the control and management of the trustees of Cornell University. The latter have amended the university statutes to recognize the station as an integral part of the university, subject to the jurisdiction of the Agricultural College Council. A director of experiment stations is provided to preside over the staff for research of the college of agriculture, the station work at Geneva, the Long Island farm for market gardening, and any other outlying experimental work. Dr. R. W. Thatcher, for the past two years director of the State station, has accepted the new directorship, with the exceptional opportunity which the unified administration offers. Thus in another State, one of the last to change, the research work in agriculture has been brought into unison with the college of agriculture and under its administrative control.

In the case of two of the figures whose retirement is now announced, their period of service has been well-nigh contemporaneous with that of their respective institutions.

The Office of Experiment Stations was organized October 1, 1888, and the appointment of Dr. True as a member of its staff occurred in the following spring. One of the first projects undertaken by the Office was the collection of information and statistics regarding the history and status of agricultural education and research in this country. The results of this inquiry were embodied by Dr. True in a report for the Paris Exposition of 1889. A little later he was prominent in the inauguration and development of this journal, designed as an aid to those engaged in teaching and investigation. For a number of years he was its editor, and many of the editorials

from that time to more recent years were from his pen. He became director of the Office in 1893, serving in that capacity until the States Relations Service was organized and through the eight years of the latter's existence. For nearly thirty-five years, therefore, he had been continuously associated with this branch of the Department's relations, and for thirty years in an administrative position as directing head.

During this administrative period Dr. True found time for study and the development of plans and ideals suited to our American institutions. He has been chairman of the committee on Methods of Teaching Agriculture from its organization in 1895, and has presented a notable series of reports to the Association of Land-Grant Colleges. He was president of the latter body in 1913, and for many years has served as its bibliographer. The profound influence which Dr. True has exercised upon the organization of agricultural research and teaching, and the ideals and methods which have been crystallized in these institutions, is universally acknowledged.

The entire active career of Dr. Jenkins is centered in a single institution. This is a remarkable fact when the number of changes in most of the stations during the early years is considered, and the extent to which the workers transferred from one institution to another. He went to the Connecticut State Station as assistant chemist in 1877, when it was transferred from Middletown to New Haven. This was after his graduation from Yale and return from a year's study at the University of Leipzig. He was one of the two chemists who with the director, Dr. S. W. Johnson, formed the entire staff of the station. He has been continuously in its service from that time to the close of June, a period of nearly forty-seven years. In 1883 he became vice-director, and on the retiremennt of Dr. Johnson in 1900 he succeeded him as director. Since the consolidation of the administrative control of the State and Storrs Stations in 1912, he has served as director of both, and has rendered a valuable service in coordinating their activities in such a way as to avoid needless duplication and make them better meet the needs of the State.

Including his period as vice-director, Dr. Jenkins' executive duties have covered a span of forty years, while his entire period of service is not only the longest at a single institution of any worker now living but exceeds that of any surviving member of the station forces. To few men is the opportunity given for a comparable period in which to formulate and carry into execution plans for the consistent development and up-building of a research institution. It is of interest to note in this connection that of all the directors in charge of the stations at the time of Dr. Jenkins' appointment twenty-three years ago, only three remain at the head of their respective institutions.

These are Dean C. F. Curtiss of Iowa, Dr. H. J. Patterson of Maryland, and Dean J. L. Hills of Vermont. Dr. Jenkins has been identified with the Association of American Agricultural Colleges and Experiment Stations almost from the beginning, serving on various committees including the executive committee, and being the first chairman of the section of experiment station work, in 1903. He was president of the Association in 1912.

The experience of the third member of this trio has differed materially from that of Dr. True and Dr. Jenkins, in that it has included sojourn at a number of institutions. Starting his career as an assistant to the State Entomologist of Illinois in 1885, Dr. Hunt served in turn as assistant in agriculture in the University of Illinois and its experiment station from 1886 to 1891, as professor of agriculture in the Pennsylvania State College in 1891–2, and as professor of agriculture and later dean of the college of agriculture and domestic science at Ohio State University, from 1896 to 1903. From there he was called to the college of agriculture at Cornell University as professor of agronomy, serving four years and then going back to Pennsylvania as dean of the school of agriculture and director of the station from 1907 to 1912. In the latter year he was made dean of the college of agriculture of the University of California, being likewise director of the station till 1917.

Dr. Hunt's experience has thus been a broad and varied one, ranging from the East through the Middle West to the Pacific Coast regions. Each successive step has been an advancement and a recognition of his growing prominence in the field of agricultural education. It was largely through his influence that the first session of the Graduate School of Agriculture, fostered by the Association of American Agricultural Colleges and Experiment Stations, was held at Ohio State University where he was then serving as dean of agriculture. His deep interest in methods of agricultural instruction is reflected in his many years of service on the committee of the Association dealing with that subject. During the war he was selected as one of the members of an agricultural commission sent abroad by the Federal Government, and in 1920–21 he served as resident delegate of the United States to the International Institute of Agriculture at Rome.

Although the pressure of administrative duties afforded little opportunity to any of these three for the personal prosecution of scientific research, their attitude has been consistently one of the utmost sympathy and encouragement. Naturally from the position he occupied for many years Dr. True gave special study to the organization and conditions for research, marked its progress in different sections and under varied environment, and by his official

attitude brought about a sharper differentiation between the work of the station and other branches of the college. He stressed the fundamental importance of research as the basis for the growth and effectiveness of the college in its other lines of work, and he pointed out the necessity of making adequate provision for it.

His view was clearly expressed in his presidential address before the Association. In that connection he said: "Research is not merely an incidental function of our agricultural colleges. It is under the law a necessary part of their business, and they have large amounts of public money which can be lawfully spent only for this purpose. But beyond this it is fundamental and essential to their success in teaching and extension work. They are therefore under the greatest obligation to create within themselves the atmosphere and conditions most favorable to successful research."

This address, as well as the presidential address of Dr. Jenkins, was delivered just prior to the enactment of the Agricultural Extension Act, and it is characteristic that both of them welcome this proposed legislation, among other reasons, for the stimulus and opportunity which it would bring to research.

Dr. Jenkins viewed this measure as a "call for thorough, fundamental work on the principles underlying successful farm practice." He drew attention to the fact that "many of the easy, the obvious, the striking things have already yielded their results. The work of our stations is no longer surface mining. It requires more complicated machinery, greater skill, and will make slower visible progress, less showy, with less appeal to popular fancy. It is fundamental work and, therefore, out of sight. The Adams Act, with the interpretation put upon it by the wisdom of the Secretary of Agriculture and the director of the Office of Experiment Stations, has done incalculable service to the stations, and indirectly to the cause they serve, by calling us and forcing some of us to the work of systematic, patient, continued research. All of the distinctive work of the stations, whether supported by the Adams fund, the Hatch fund, or State appropriations, should approach more nearly to the kind of work for which the Adams Act as interpreted by its administrators now provides."

Although the Connecticut State Station early made fertilizer inspection a prominent feature, and has encouraged the assignment to it of various other regulatory functions in the interest of economy and of freedom from the dangers of political connections, care has been exercised to organize such service so that it would not hamper the progress of research, and to rest it at all times on the soundest basis which science could provide. The station has long been notable for its investigations in methods and in the interpretation of regu-

latory findings, especially in fertilizers, foods, and drugs. It has been one of the efforts of Dr. Jenkins to make, as he has said, "an atmosphere and a somewhat comfortable place for research workers." In this he has been very successful. The sympathetic interest, the encouragement, and the protection he has given have been assets which all investigators will understand.

While Dr. Hunt's career has been largely as a teacher, administrative officer, and writer, he has fully acknowledged the place of research in the advancement of agriculture and the development of agricultural institutions, and he has exemplified this feeling in his organization. He has drawn together a large group of research workers, many of them of national reputation, and he has furthered their efforts by securing appropriations and affording opportunity and facilities which have made the California Station one of the largest and most prominent in the system.

While these men relinquish the details and responsibilities with which they have so long been charged, they are not to be permitted to retire into inactivity. Dr. Jenkins has been made director emeritus and has been granted a retiring allowance "quite beyond reason" as he puts it, which while a grateful acknowledgment may carry with it an indication of expectations. Surely his counsel and words of encouragement will continue to be looked for by those who have been so genuinely helped by them. If out of his interesting experience he could record something of the history of events as he has seen them pass, or viewing these in retrospect could draw some lessons and suggestions from them, it would be a valuable contribution.

In retiring from the deanship of the college of agriculture, Dr. Hunt does not sever his connection with the institution. He becomes dean emeritus and will continue as professor of agriculture. It is hoped and expected that he will undertake some teaching, as his health permits, and will contribute further with his pen to the volume of agricultural literature. It will be fortunate if this is so, for in addition to organizing a great college of agriculture he has had a wide experience with opportunity to study the condition of the industry in widely separated regions. The fruit of his study of agricultural questions should be valuable to the entire country.

Dr. True becomes Specialist in States Relations, attached to the Office of the Secretary in order that his services may be applicable to the whole Department. He will exercise immediate supervision over the work the Department is doing for the aid of agricultural schools and similar institutions, and will round out his study of the history of agricultural education and research in this country. Such a study and interpretation has long attracted him, and the value of

such a thorough and systematic survey makes it fortunate that the way has been opened for it.

The period which these changes bring to mind has been marked by development well-nigh revolutionary. In no respect is it more noticeable than in the relation of the Federal Government to agricultural education and research. The colleges which formerly received only grants of land have become the beneficiaries of successive acts which not only have added materially to their appropriations but, what is even more important, have set in motion new features on a national scope. The idea of what the States and the Federal Government should each do has become more liberal, and the joint obligation of the two governments has become broadly recognized.

The principle of Federal aid in education in these lines has become firmly established, and this system of colleges has been definitely accepted as the agency through which the Federal Government will extend its aid to the States in these matters. While naturally the response has not been equal in all the States, the influence has been felt in all of them, as reflected in their organization and the ends towards which they are working.

In this time the subject of agriculture for purposes of instruction and research has been analyzed and segregated into constituent parts, with the development of specialization in place of the impossibly broad fields of activity which long prevailed. A body of scientific fact has been developed; a large group of specialists has been trained and adapted; and graduate study in agricultural branches has come to occupy a place of no small importance in these colleges. The conception of the college as a teaching institution has been tremendously enlarged and clarified. Its duties are seen to be much broader than to those who come to its campus for study, while its relations to the State have become more intimate than those of any other class of educational institutions.

The Federal appropriations to the experiment stations have been doubled, and their total support from all sources increased manyfold. The understanding of research and its fundamental importance to teaching and to progress in agricultural affairs has penetrated to a large share of the public, and has brought its response. A nation-wide system of extension teaching has been organized and put into effect, and the campus of the college has been extended to the whole State. This in turn has been followed by a system of secondary instruction as a result of the interest and confidence the colleges have aroused, in which they have a part. Thus the colleges whose progress was so long delayed have taken the large place they were destined to occupy.

This period of incomparable development has not resulted without wise foresight and hard, continuous effort. The various steps in advance by which these colleges have been built have followed one another in logical succession, as part of the working out of a plan, and they have brought with them many intricate problems requiring close study and wise counsel in administration. The result is a fascinating study of the growth of an idea. It is a product of the past and of those who have played their part in it.

RECENT WORK IN AGRICULTURAL SCIENCE.

AGRICULTURAL CHEMISTRY—AGROTECHNY.

Fruit jellies.—I, The rôle of acids, L. W. TARR (*Delaware Sta. Bul. 134 (1923), pp. 38, figs. 10*).—This publication reports in detail the experimental data obtained in a quantitative study of the rôle of acids in the formation of fruit jellies which has been previously noted from a preliminary report (E. S. R., 48, p. 612). As here noted, the governing factor in the formation of optimum jelly with definite amounts of pectin and sugar appears to be the H-ion concentration of the acid rather than the total acidity. With a sugar-pectin ratio of 62.5 gm. to 1 gm., the H-ion concentration at the minimum jellying point was pH 3.4 and at the optimum jellying point pH 3.1, whatever acid was used.

In order to determine the effect of various acids on pectin alone a 1 per cent pure pectin solution in distilled water was prepared. Acids were added in small, accurately measured quantities to 100 cc. of distilled water and 100 cc. of the pectin solution, H-ion concentration determinations being made in each case after each addition of acid. The results showed that pectin exerts a buffer effect, the H-ion concentration being lower in the pectin-acid than in the corresponding distilled water-acid solutions. This indicates the possible formation of pectin-acid compounds.

The total amount of acid required varied with the particular acid employed. For example, to produce an H-ion concentration of pH 3.5 with the 1 per cent pectin solution required approximately 2.6 cc. of N/10 sulphuric acid, as compared with 5.5 cc. of N/10 tartaric, 7.5 cc. of N/10 phosphoric, and 8.5 cc. of N/10 citric acid.

A series of experiments in which two different weights of sugar were used with a constant amount of pectin indicated that at the "jell point" a very definite equilibrium exists between pectin, sugar, acid, and water.

When two different pectin stock solutions were used, differences in H-ion concentration were observed which may be explained on the basis of the salt content of the pectin solutions.

Of the three acids predominating in fruit juices, the most efficient for jelly making purposes is thought to be tartaric, since it furnishes a higher concentration of H-ions than either malic or citric. Measured in terms of total acidity, about twice as much citric as tartaric acid is required to make a jelly.

It seems reasonably certain in view of these experimental results that the critical H-ion concentration of each particular fruit juice is practically constant. Slight variations in fruit juices may be due to differences in their salt concentrations.

Effects of the method of desiccation on the carbohydrates of plant tissues, K. P. LINK and W. E. TOTTINGHAM (*Jour. Amer. Chem. Soc., 45 (1923), No. 2, pp. 439–447*).—A study is reported from the Wisconsin Experiment Station and the Bureau of Plant Industry, U. S. D. A., of suitable methods of preserving plant tissues by heat to check enzymic and respiratory activity without altering appreciably the chemical composition.

Five different types of tissue were selected—beet leaves, corn ears, cornstalks, corn seedlings, and potato tubers. These were taken directly to the laboratory and reduced to smaller fragments as follows: The beet leaves were cut into pieces 10–12 mm. square, the corn ears were split once longitudinally and cut into pieces 60–80 mm. long, the cornstalks were split six times longitudinally and cut into pieces 20–25 mm. long, the corn seedlings were cut into pieces 10–12 mm. long, and the potato tubers were sliced transversely in pieces 6–7 mm. thick. Equal quantities of the material thus prepared, approximating about 50 gm. in dry matter, were placed in various drying ovens previously regulated to the desired temperature and were dried to constant weight. The dried tissues were then ground to pass through a 100-mesh sieve and used for determinations of reducing and total sugars, dextrins, and starch, all data being calculated to dry matter as determined by drying a sample to 100° C. The various sources of heat were partially ventilated ovens 20 by 20 by 45 cm., with a pressure of 35 mm. at both 65 and 80°; unventilated ovens 58 by 30 by 40 cm. at 98°, and trays of wire netting at the center of a drying room 2.4 by 1.8 by 1.2 meters at 65°, ventilated by means of a 30-cm. electric blower.

The temperature of 98° proved unsatisfactory in all cases on account of caramelization of the starches and sugars. Heating at 80° in vacuo proved the most generally satisfactory method. In the case of coarsely divided tissues such as corn ears, better results were obtained by a preliminary heating of the tissue in an autoclave. Heating at 65° in vacuo proved unsatisfactory, but heating at the same temperature in an air current gave good results with corn seedlings and potato tubers and is recommended for all tissues which can be reduced to thin sections. For more watery tissues and those not reducible to thin sections, the vacuum oven at 80° is recommended. None of these methods is recommended when the determination of soluble protein is required.

Influence of some organic compounds upon the hydrolysis of starch by salivary and pancreatic amylases, H. C. Sherman and N. M. Naylor (*Jour. Amer. Chem. Soc. 44 (1922), No. 12, pp. 2957–2966*).—With a view to obtaining some light on the cause of the favorable effect of amino acids on the hydrolysis of starch by amylases as shown by previous papers (E. S. R., 48, p. 608), a study was made of the effect upon such hydrolysis of different compounds selected "to contain the amino group in anilin sulphate and in methyl and ethyl amin hydrochlorids, the carboxyl group in benzoic acid, and the amid group in benzamid; to show the effect of the position of the amino group by studying glycin, in which the amino group is alpha to the carboxyl group, and anthranilic acid in which the amino group is ortho to the carboxyl group; to show the effect of substitution of the hydrogen of the amino group, as in hippuric acid; and to test the influence of indol and guanidin, and to compare their effect with that of the amino acids containing these groupings."

The tests were conducted by the standardized method used in previous work from the senior author's laboratory, the mixtures being activated by sodium chlorid and sodium phosphate and made up to the correct H-ion concentration for the enzym. In addition, the hydrolysis was concluded in the absence of the activating salts.

Under the former conditions methyl and ethyl amin hydrochlorids, anilin sulphate, benzoic acid, benzamid, anthranilic acid, and hippuric acid failed to show any favorable effect upon the activity of the enzym. In the absence of the salts methyl and ethyl amin hydrochlorids activated the enzym, while anilin sulphate did not. This difference is attributed to the favorable effect of the Cl ions. Anthranilic acid, hippuric acid, and glycin in the absence of inorganic salts showed no activating influence when 0.4 cc. of pure saliva per

100 cc. of starch was used, but when the concentration of the enzym was doubled an activating influence was noted.

Glycin activated the enzym in the presence of salts, while hippuric acid did not. That the failure of the latter was not due to its hydrolysis during digestion with the formation of glycin and benzoic acid was shown by the fact that the H-ion concentration was the same before as after digestion, and that a mixture of glycin and benzoic acid acted the same as glycin alone.

The influence of indol and guanidin on the amyloclastic activity of the pancreatic amylase was next tested. Guanidin had no effect and indol an inhibitory effect.

Tests of the effect of alanin, phenylalanin and tryptophan on the saccharogenic activity of the amylase gave positive results. The previous observation that tryptophan did not exert a favorable effect on the amyloclastic action of the enzym (E. S. R., 46, p. 708) places it in the class with lysin as noted.

The origin of the humin formed by the acid hydrolysis of proteins.—VII, Hydrolysis in the presence of ketones, R. A. Gortner and E. R. Norris (*Jour. Amer. Chem. Soc., 45 (1923), No. 2, pp. 550–553*).—With a view to throwing further light on the nature of the substance which has been shown in previous papers of the series (E. S. R., 44, p. 501) to combine with tryptophan to form humin in the hydrolysis of proteins, fibrin was hydrolyzed alone and in the presence of varying amounts of acetone, and determinations were made of the nitrogen distribution in the products of hydrolysis. Tryptophan and tyrosin were also boiled for 24 hours with 20 per cent hydrochloric acid in the presence of acetone or acetophenone.

No evidence was obtained that the presence of ketones alters the nitrogen distribution of a protein as measured by the Van Slyke method, or that the acid-insoluble humin of protein hydrolysis is formed by the action of a ketone with tryptophan. This is thought to confirm the previous suggestion that the unknown component of proteins which is involved in humin formation is in all probability an aldehyde.

The autolysis of beef and mutton, W. R. Fearon and D. L. Foster (*Biochem. Jour., 16 (1922), No. 5, pp. 564–571, figs. 6*).—In the hope of throwing some light on the well-known differences in the effect of cold storage on beef and mutton, a comparison was made of the course of autolysis in sheep and ox liver and then in muscular tissues of the same animals as followed by successive estimations of the soluble nitrogen in an aliquot of a 20 per cent suspension of the material in toluene water. On plotting the time in days against the soluble nitrogen in percentage of total nitrogen no appreciable difference could be noticed in the progress of autolysis either at 0° or at 37° C. In the case of mutton, equilibrium was reached at a higher percentage of soluble nitrogen than in beef, but the curves were parallel as the initial noncoagulable nitrogen was higher. It is concluded that the differences in the two kinds of meat lie in the structure and physical properties rather than in the chemical constitution.

Similar determinations were also made of the soluble nitrogen of samples of meat which were frozen in the air or in brine and kept in cold storage in the frozen state for several days, after which they were allowed to thaw and subjected to autolysis at incubator temperature as before. The rate of autolysis of the samples which had been brine-frozen followed very closely that of the unfrozen control samples and was much more rapid in the other samples.

"It is very difficult to explain this effect on autolysis produced by freezing. Obviously the equilibria of the cell have been disturbed by the rupture of the membranes which occur during slow freezing. As there is an absence of 'drip' after brine freezing it would seem that by this method any extensive damage

to the cell is avoided, and this is borne out by the autolytic changes in the brine-frozen beef."

Analysis and composition of corn pollen (*New York State Sta. Rpt. 1922, p. 29*).—A brief note is given of a continuation of the study of the composition of corn pollen (E. S. R., 47, p. 12).

The crystalline substance which separates from the absolute alcohol extract of the pollen has been identified as an ester of phytosterol and palmitic acid. The ether extract was found to contain a large percentage of a saturated hydrocarbon melting at from 63 to 64° C. and which is apparently normal nonakosan, $C_{29}H_{60}$. From both the ether extract and the alcoholic extract a number of phytosterols were obtained. From aqueous alcohol the phytosterols crystallized without any water of crystallization were optically inactive, and ranged in melting point from 122 to 154°. The melting points of the corresponding acetyl derivatives ranged from 101 to 114°.

Attempts to isolate the phosphatid from corn pollen in amounts sufficient for examination have thus far been unsuccessful.

The microscopical examination of foods and drugs, H. G. Greenish (*London: J. & A. Churchill, 1923, 3. ed., rev., pp. XVII+386, figs. 209*).—In this laboratory manual on the microscopic examination of foods and drugs in the entire, crushed, and powdered states, the subject matter has been selected to proceed from the simplest materials, the starches, to the most complex, fruits and roots, typical examples being selected to illustrate different principles.

The nitrometer method for the determination of nitrogen in nitrates and nitric acid, H. W. Webb and M. Taylor (*Jour. Soc. Chem. Indus., 41 (1922), No. 23, pp. 362 T–364 T*).—An investigation is reported of the accuracy of the nitrometer method of determining nitrogen in nitrates and nitric acid, the determinations being checked in the first case by direct weighing and in the second by titration against standard sodium hydroxid solution.

From the data reported, it is concluded that the nitrogen in potassium nitrate can be determined with accuracy by means of the nitrometer when 91 to 92 per cent sulphuric acid is used and the solubility of the nitric oxid in this acid is assumed to be 0.2 cc. in 10 cc. of the acid. In the determinations of nitrogen in nitric acid, values agreeing within 0.15 per cent of those obtained by titration may be obtained if the acid is weighed in such a way as to avoid the loss of fumes. This is accomplished by weighing a large quantity of the nitric acid with a known weight of strong sulphuric acid in a deep vessel and weighing the necessary amount of the mixed acid into the nitrometer. It is recommended that the nitrometer be used in a room free from rapid changes in temperature, and that the temperature be read before the volume of gas.

Flour strength as influenced by the addition of diastatic ferments, F. A. Collatz (*Amer. Inst. Baking Bul. 9 (1922), pp. 74, figs. 12*).—In continuation of the research on the diastatic enzyms of flour, the first report on which by Rumsey has been noted previously (E. S. R., 48, p. 504), an investigation is reported of the effect on flour strength of the addition of diastatic ferments.

An extensive review is given of the literature on the relation of the proteins and carbohydrates of wheat flour to flour strength and on diastatic and proteolytic enzyms, following which experimental work is reported on the effect upon the baking strength of 7 of the samples of flour used in the previous investigation of the addition of a commercial malt flour and a commercial malt extract. The Munson-Walker method of determining reducing sugars was used as a measure of diastatic activity and the amino nitrogen method of Van Slyke and the viscosity method of Sharp and Gortner for determining proteolytic acitivity. Other values determined were the buffer value, the gas-producing capacity, and the baking value.

Preliminary studies of the influence of varying conditions on the diastatic activity of the malt flour showed that with a raw starch substrate the optimum activity occurred at pH 4.26 and at a temperature of 65° C. At a temperature of 27° the reaction proceeded at the same rate for at least 8 hours. On increasing the percentage of malt flour the added diastases exerted their greatest effect in the first 10 per cent.

To determine the effect of the diastatic enzyms of malt extract and malt flour upon the different flours, sugar determinations were made after digestion at 27° for one hour of doughs prepared from 3 flours representing a strong type Canadian patent flour, a decidedly weak Pacific coast patent flour, and a clear Kansas flour. Each was mixed with various amounts of the diastatic preparation, including 1.5 per cent malt flour, 4 per cent malt flour, and 3 per cent malt extract. Controls with no diastase and with no yeast were also included. No sugar was added to any of the doughs. The general results of this phase of the investigation are summarized as follows:

"An addition of diastatic enzyms to a dough resulted in a surplus of reducing sugars during the earlier stages of fermentation. This surplus was used up in the later stages of fermentation along with the sugars simultaneously produced by the diastatic enzyms. It also appeared that yeast activity was increased to a considerable extent when the carbon dioxid was punched out of the dough. At least it semes to have been coincident with the punching of the dough in the case of the stronger flours. It was also evident, from the amounts of reducing sugars available, that the flours which showed good baking qualities had a greater diastatic activity than did the flour of poor baking strength. The malt preparations when added to weak flours produced less sugars in proportion than when added to strong flours."

A method for the quantitative determination of gelatin in ice creams, L. W. Ferris (*Jour. Dairy Sci., 5 (1922), No. 6, pp. 555–564*).—The tentative qualitative method of the Association of Official Agricultural Chemists for the detection of gelatin in milk has been found to give a good approximation of the amount of gelatin in ice cream when the turbidity produced by the addition of picric acid as directed is compared in a nephelometer with a standard 0.01 per cent gelatin solution treated in the same way. To obtain a turbidity that can be measured in the nephelometer, it was found necessary that the filtrate, after the removal of the protein with acid mercuric nitrate, should contain from 0.025 to 0.005 per cent of gelatin. It is also necessary for the standard gelatin solution to contain acid mercuric nitrate in as nearly as possible the same amount as the unknown solution.

For more accurate results a method is recommended in which, after precipitation of the casein with acetic acid, the gelatin is precipitated with alcohol and dissolved in water and its percentage calculated from its nitrogen content and from it specific rotation at 35° C. as determined by the method of Smith (E. S. R., 44, p. 313). Two procedures for this method are described which differ only in the preliminary treatment of the ice cream. In one 450 gm. of the ice cream is weighed into a 500-cc. flask, warmed to 35°, and diluted to the mark, after which it is transferred to a larger flask and treated with 10 per cent acetic acid until the casein is coagulated, noting the volume required. The volume of the serum is then calculated by subtracting the sum of the volume of the fat (weight of fat in sample×1.075) and the volume of casein (weight of casein in sample×0.73) from 500+the number of cubic centimeters of acetic acid. The curd is separated from the serum by centrifuging, after shaking with a small amount of tetrachlorid if the curd does not settle readily, and 100 cc. of the serum is measured into a 400-cc. lipped beaker

and the gelatin precipitated while still warm by adding slowly, with stirring, 200 cc. of 95 per cent alcohol.

In the other procedure 450 gm. of the ice cream is weighed into a beaker and warmed to 35°, after which 10 per cent acetic acid is added to the undiluted material until the casein is precipitated. After thorough mixing the serum is separated by filtering or centrifuging, and a 5-cc. aliquot is neutralized, diluted to 50 cc., and used for the determination of reducing sugars. The total volume of the serum is calculated by dividing the weight of reducing sugars in the 450-gm. sample of ice cream by the weight of reducing sugars in 1 cc. of the serum. The serum is precipitated with alcohol as in the above procedure. The precipitate in both cases is allowed to settle over night in an ice box, filtered on hardened paper in a Buchner funnel, and washed with cold 95 per cent alcohol diluted with half its volume of water. The precipitate is removed to a small beaker, soaked in 50 cc. of water until the gelatin swells, heated to about 90° in the hot water bath, filtered, and washed with water, when it is ready for the polarization.

Data reported on the analyses of 21 samples of ice cream mix prepared with varying percentages of fat, milk solids-not-fat, sugar, and gelatin show that the gelatin can be quantitatively recovered by this method, at least when no further thickeners have been added. The effect of gum and other ice cream thickeners upon this determination has not yet been tested.

The limits of the agglutination test for ricin, H. Waites (*Jour. Soc. Chem. Indus., 41 (1922), No. 8, pp. 113 T, 114 T*).—To determine the amount of ricin in extracted castor meal residues the author makes use of the agglutination test with guinea pig blood, using as the standard of comparison an extract of castor seed from which only the oil has been removed by pressure at ordinary temperature. The standard extract is prepared by mixing 100 gm. of the meal with 400 cc. of Ringer's solution, allowing it to stand for 24 hours with frequent stirring, and filtering through three thicknesses of filter paper in a Buchner funnel. The material to be examined is treated in the same manner. Dilutions of the extract are made in 1:100, 1:200, and 1:500 concentration and used in 2, 1.5, 1, and 0.5 cc. amounts in the usual manner with 1 cc. of defibrinated guinea pig blood. The ratio of 1:2,000 proved to be the limit to be expected from the agglutination test. For lower toxicities it is necessary to employ the subcutaneous injection method by means of which a dilution of 1:40,000 can be detected.

A modification of the Folin-Wu blood sugar method, S. Morgulis, A. C. Edwards, and E. A. Leggett (*Jour. Lab. and Clin. Med., 8 (1923), No. 5, pp. 339–341*).—In this modification of the Folin-Wu blood sugar method (E. S. R., 41, p. 13), the authors employ the arsenic phosphotungstic acid reagent recommended by Benedict for the determination of uric acid in blood (E. S. R., 47, p. 315). The procedure is the same as that of Folin and Wu through the boiling of the blood filtrate with copper sulphate. The tubes are then removed from the water bath, and to each is added 1 cc. of the modified sugar reagent. This is prepared by adding 8 cc. of concentrated hydrochloric acid to 100 cc. of the Benedict uric acid reagent. The tubes are then cooled by submerging under cold water for 3 minutes, after which 1 cc. of 10 per cent sodium hydroxid is added, and the contents of the tube are diluted with water after standing for 5 minutes. After another 5 minutes the colors are matched in a colorimeter.

A modified Haldane open-circuit apparatus for measuring the respiratory exchange in newborn babies and also in rabbits and cats, D. Marine (*Jour. Metabolic Research, 2 (1922), No. 1, pp. 29–37, figs. 3*).—A modified

Haldane open-circuit apparatus for measuring the respiratory exchange in newborn babies and in rabbits and cats is described in detail, with accompanying diagrams and photographs. Data obtained by the author, with the assistance of A. Cipra and B. H. Lowe, on its use in determining the respiratory exchange of a cat and of a baby are reported. For cats and rabbits a 2-hour observation period was adopted as a standard and for babies a 1-hour period.

METEOROLOGY.

The evolution of climates, M. MANSON (*Baltimore: Lord Baltimore Press, 1922, pp. 66, fig. 1*).—In this paper the author rejects the assumption that solar control alone prevailed during any period of geological times, but holds that heat stored in the earth and liberated unequally at different times has been an important factor in determining climatic conditions.

The water in the atmosphere, G. C. SIMPSON (*Nature [London], 111 (1923), No. 2789, Sup., pp. V–XII*).—This paper deals with condensation of water vapor above and below the freezing point to form haze, mist, clouds, rain, hail, and snow.

Climate of British Columbia, compiled by F. N. DENISON (*Brit. Columbia Dept. Agr. Bul. 27, 7. ed. (1922), pp. 15*).—This is the seventh edition of this document, bringing the record up to the end of 1921. It is stated that "the year 1921 was notable for abnormally heavy rains on Vancouver Island and the lower mainland and serious floods in the latter district. The spring and summer were also unusually cool, particularly in the western portion of the Province."

Meteorological observations in Assam, C. R. HARLER (*Indian Tea Assoc., Sci. Dept. Quart. Jour., 1922, No. 1, pp. 10–21, pl. 1*).—This article deals with weather conditions in Assam in 1921 and previous years as related especially to the tea crop, and reports pot culture experiments in which "the relationship between temperature, humidity, and rate of transpiration has been observed and correlated with the observations of other workers made on different plants. . . .

"Observations show that the ideal tea weather is, maximum temperature about 92° F., minimum temperature, accompanied by saturation, about 82°. These values naturally vary with other factors like wind and radiation.

"It seems probable that humidity affects the amount of growth rather than the rate of growth, which depends more on the temperature. Thus a high humidity might force two shoots instead of one, but a high temperature would bring about rapid growth of these shoots."

It is stated that "with regard to the fully grown bush, the months of March, April, and May following on the cold weather drought are critical, and during this period unless rain falls the bushes are seriously affected. . . .

"It has also been noticed that the rate of transpiration is an index of the health of the plant. When transpiration decreases, wilting or blight attack, not evident at the time, follows in a few days."

The "degree of wetness," calculated by multiplying the rainfall by the number of wet days and dividing by the number of days in the month, is used as a means of correlating rainfall with crop. A comparatively close correlation is obtained by this means for short periods.

The season of 1921 was normal from the standpoint of the tea crop, except for a shortage of rainfall in November. On the whole the season was a very wet one, and this made for good wood growth. The relation between crop, rainfall, temperature, and vapor pressure for the season of 1921 is charted, and a list of 8 references cited in the text is given.

Meteorology (*Ann. Serv. Bot.* [*Tunis*], *No. 1 (1920–1921), pp. 2–15*).—Observations on pressure, temperature of the air and soil, rainfall, evaporation, humidity, radiation, and wind at the meteorological station of the botanical service of Tunis are summarized and briefly discussed with reference to their bearing on plant growth.

SOILS—FERTILIZERS.

A new method of mechanical analysis of soils, D. S. Jennings, M. D. Thomas, and W. Gardner (*Soil Sci., 14 (1922), No. 6, pp. 485–499, figs. 6*).—In a contribution from the Utah Experiment Station, a new method for the rapid and accurate mechanical analysis of soil is described, which is said to be applicable to a range of sizes from fine sand to colloidal material. The method consists in shaking a dilute, fully deflocculated soil suspension in a cylindrical vessel, placing the latter in an upright position, and determining the concentration as it changes with the time at measured distances below the surface. Sodium carbonate is used as the deflocculating agent, and the best concentration has been found to be from 0.015 to 0.03 per cent.

It has also been found important in this method to adjust the suspension density within certain limits. The data indicate so far that about 0.2 per cent of material below 5 μ radius is appropriate, but this point is thought to need further investigation. The method may be used either for conventional routine work or for a detailed study of the size-frequency distribution of the particles, and experimental data are submitted showing that it agrees closely with a reliable sedimentation method. It is also thought that the method offers a quantitative means of studying flocculation phenomena and yields valuable information concerning the colloidal properties of soil.

Agricultural conditions in St. Joseph County, M. M. McCool (*Michigan Sta. Quart. Bul., 5 (1923), No. 3, pp. 142–148, figs. 3*).—The results of a survey of the soils of St. Joseph County are briefly presented, with particular reference to their content of fertility constituents, fertilizer requirements, and the influence of farming practices on soil conditions.

The studies of humus content indicate that soils of the county which have decreased in productivity contain much less humus than the corresponding soils which have not been placed under cultivation. The phosphorus content of the uncropped soils in the county is said to be not high and for the most part does not vary greatly. The phosphorus content of cropped soils which have reached a low state of fertility was found to be from 21 to 50 per cent lower than that in virgin soils.

The laterite soils of Goa, P. C. Afonso (*Trop. Agr.* [*Ceylon*], *59 (1922), No. 5, pp. 276–280*).—Mechanical, chemical, and cropping studies of the laterite soils of Goa in Portuguese India are briefly reported, indicating that these soils compare favorably with similar soils in British India. There is said to be a possible deficiency of phosphoric acid and nitrogen in the Goa soils, while potash is apparently present in sufficient amounts. The porosity and permeability to water of these soils are considered to be their most important features. Ammonium sulphate gave the best results in rice cultivation.

Studies of "djati" forest soils in Java, N. Beumée-Nieuwland (*Dept. Landb., Nijv. en Handel* [*Dutch East Indies*], *Meded. Proefsta. Boschw., No. 8 (1922), pp. [2]+91*).—Chemical and physical studies of the "djati" forest soils of Java are described in this report. A large amount of tabular data, together with a bibliography, is appended. No direct relation was found between the results of chemical analyses of these soils and their apparent degree of productiveness. In general these forest soils were found to contain suffi-

cient amounts of plant nutrients, in some cases the phosphoric acid content being especially high.

Action of solutions of neutral salts on soils.—Contribution to knowledge of soil acidity, J. VAN DER SPEK (*Dept. Landb., Nijv. en Handel [Netherlands], Verslag. Landbouwk. Onderzoek. Rijkslandbouwproefsta., No. 27 (1922), pp. 162–202, figs. 2*).—Experiments are described in which a number of acid and alkaline soils were treated with various neutral salt solutions and the resulting H-ion concentrations determined by the electrometric method. Marked differences in this respect were observed in the effects of the different salts. The different actions of salts with the same anion or cation, and the fact that the course of the reactions leading to equilibrium followed an adsorption isotherm, would indicate that these variable effects were the results of adsorption phenomena. On the other hand, the equivalent interchange of cations and the course of reactions leading to the formation of substances of increased or decreased dissociation in solution favored the view that chemical phenomena only were involved. Reactions occurred between free ions in solution and adsorbed ions.

These results are discussed with reference to their bearing on the nature of chemical reactions in soils and the determination of soil acidity. The opinion is expressed that the estimation of soil acidity with litmus paper is inaccurate, and that the colorimetric estimation of soil acidity is best carried out with a salt solution extract. In the latter process the results are said to be unreliable unless standard conditions of concentration and quantity of soil and of extracting solution are maintained.

Adsorption of plant food by colloidal silica, R. C. WILEY and N. E. GORDON (*Soil Sci., 14 (1922), No. 6, pp. 441–448*).—Studies conducted at the University of Maryland on the adsorption of nutrient salts by the hydrogel and hydrosol of silica are reported. These were conducted on the assumption that soil colloids at times exist as a hydrogel and at other times as a hydrosol.

It was found that in general the metals are negatively adsorbed by both the hydrogel and hydrosol, while the nitrate and sulphate radicals of calcium, magnesium, and potassium in general suffer a slight negative adsorption. The phosphate radical was found to be adsorbed positively by the hydrogel and negatively by the hydrosol. In the case of the hydrogel, the phosphate radical was adsorbed to a greater degree than the radical with which it was associated. It was found further that phosphate adsorbed in the hydrogel can be washed only with extreme difficulty.

Influence of H-ion concentration on the adsorption of plant food by soil colloids, E. B. STARKEY and N. E. GORDON (*Soil Sci., 14 (1922), No. 6, pp. 449–457, fig. 1*).—Studies conducted at the University of Maryland on the adsorption of soil nutrients by single soil colloids under varying H-ion concentrations are reported, the purpose being to throw some light on how acidity or alkalinity of soil affects adsorption of plant nutrients and the availability of soil salts. The salts used were the acid phosphates, sulphates, and nitrates of potassium and calcium, and the hydrogels used were those of silica and iron.

It was found that the adsorption of the cation as a rule increased with increased hydroxyl-ion concentration. The adsorption of the phosphate ion increased with decreased pH value in some cases. The adsorption of the nitrate and sulphate ions was not consistently influenced by the reaction of the solutions. The anions seemed to be adsorbed in the order of phosphate, sulphate, and nitrate, with phosphate well in the lead. The adsorption by ferric hydroxid gel was greater than by silicic acid gel. There was a marked change in adsorption of potassium ions for a very slight change in the H-ion concentration around the neutral point.

Contribution to the study of Azotobacter, E. KAYSER (*Ann. Inst. Natl. Agron., 2. ser., 16 (1922), pp. 11–43*).—This is a report of comprehensive studies, mainly of *Azotobacter agile*, divided into four parts.

Part 1 reports studies on the influence of luminous radiation on the activities of the organism in different culture media and under different conditions. These showed that *A. agile* is very sensitive to luminous radiation, especially to yellow, blue, and violet rays. In mannite the greatest total nitrogen fixation took place under yellow light and the smallest under violet light. The greatest nitrogen fixation per gram of mannite consumed took place under violet light and the smallest under green light and darkness. The intensity of fixation also varied with the age of the culture. In glucose, the greatest total fixation occurred under green and yellow lights, while the greatest fixation per gram took place under blue light. Less nitrogen was fixed on glucose than on mannite. A comparison of glucose and levulose media showed that the greatest fixation on the former took place with black and yellow colorations, and on the latter with white and blue colorations.

Studies of the influence of the age of the culture under different colorations showed that in general nitrogen fixation was greatest in the third generation, and that the rate of fixation varied with the coloration. The difference in fixation between the third and sixth generations was greatest under white light and least under yellow and blue. Coloration of the medium was less and took place more slowly under white light than under the other lights. The consumption of medium was greatest in the third generation for both glucose and mannite except under blue light. Under green, white, and black colorations nitrogen fixation apparently reached a minimum in the sixth generation. Further cultures up to twelve showed that, especially under yellow light, the organism destroyed considerable amounts of medium without fixing proportionate amounts of nitrogen.

Studies of the influence of temperature showed that Azotobacter fixed nitrogen more slowly at ordinary than at higher temperatures, but that it was more economical in its use of nutrient.

Part 2 reports studies on the influence of metallic salts on *A. agile*. Uranium acetate was found to increase the utilization of mannite nutrient medium, while uranium phosphate decreased it. Uranium acetate appeared to be beneficial to nitrogen fixation in glucose medium. Studies of the influence of monazite minerals in liquid and solid media showed that nitrogen fixation was increased in the former but not in the latter, so that the use of these mineral residues as soil stimulants can not be recommended.

Part 3 reports experiments which showed that the addition of apple refuse to soil markedly increased the fixation of nitrogen by Azotobacter. Part 4 reports studies which indicate that in general the addition of cultures of Azotobacter in moderate doses to carbohydrate media previous to sterilization hinders the development of alcoholic ferment to a degree varying with the strain of ferment prevailing in the medium, but, on the other hand, when increased it stimulates zymasic action and increases carbohydrate consumption and alcohol formation.

Oxidation of zinc sulphid by microorganisms, W. RUDOLFS and A. HELBRONNER (*Soil Sci., 14 (1922), No. 6, pp. 459–464, fig. 1*).—Studies on the oxidation of zinc sulphid by microorganisms, conducted at the New Jersey Experiment Stations, are reported.

These showed that microorganisms are able to transform zinc sulphid into zinc sulphate, and that the growth of these organisms is not inhibited by the resulting soluble zinc. The addition of elementary sulphur to impure cultures increased the rate of solubility of zinc blende. The Lipman sulphur-oxidizing

organisms produced sufficient sulphuric acid from elementary sulphur to render zinc carbonate and zinc silicate soluble. It is concluded that a possible biological method can be worked out for the economical utilization of low-grade zinc sulphid ores.

Modifications of the soil flora induced by applications of crude petroleum, I. L. BALDWIN (*Soil Sci., 14 (1922), No. 6, pp. 465–477, figs. 2*).—Field and greenhouse studies conducted at Purdue University on the influence of crude petroleum on soil flora are reported.

These showed that soil flora are changed remarkably by applications of crude petroleum, most types of bacteria being inhibited but some few types being greatly stimulated by its action. Mold growth was not inhibited by the action of crude petroleum. Ammonia production in the soil was slightly lowered by such treatment. The ammonia produced is considered to be probably the result of mold growth and not of bacterial action, as the bacterial types favored by crude petroleum are not able to form ammonia from organic material. When first applied, nitrate production in the soil was completely inhibited by the crude petroleum. This inhibitory action lasted over a varying period of time, depending upon the size of the application, and was followed by a period of rather slow nitrification which gradually became more intense.

While the data in regard to crop growth are not conclusive, they are taken to indicate that small applications of crude petroleum to the soil do not injure its crop-producing power. Larger applications, however, have a detrimental influence, partly because of their effect upon the physical condition of the soil. It seems that crude petroleum when incorporated in soil is gradually broken down into simpler products, when the effects of its presence are no longer apparent.

Fertilizers for spring crops, G. M. GRANTHAM (*Michigan Sta. Quart. Bul., 5 (1923), No. 3, pp. 95–97, figs. 2*).—Brief practical information on the use of fertilizers for spring crops on Michigan soils is presented

Fertilization of Michigan muck soils, P. M. HARMER (*Michigan Sta. Quart. Bul., 5 (1923), No. 3, pp. 98–100, figs. 2*).—Practical information on the fertilizer requirements of certain Michigan muck soils as determined by overstate fertilizer tests is briefly presented.

The results of the investigation indicate that all muck soils in Michigan, with the exception of some newly reclaimed areas and some very shallow mucks, are in need of potash for general farming. Very few are said to show an increase in yield when a phosphatic fertilizer is used without potash, but many show marked increases when the two fertilizers are combined.

Leguminous plants as organic fertilizers in California agriculture, P. B. KENNEDY (*California Sta. Circ. 255 (1922), pp. 8, fig. 1*).—This circular is intended as an introduction to a series dealing with leguminous crops suitable for growing under the conditions which prevail in California. It gives practical information on the action of legumes in soil when used as a green manure.

Experiments with nitrogenous fertilizers, E. HASELHOFF, O. LIEHR, and K. FLUHRER (*Landw. Vers. Sta., 100 (1922), No. 1–2, pp. 37–58*).—Studies of the fertilizer value of lime nitrogen, ammonium bicarbonate, and other air nitrogen fertilizers under different conditions are described.

In the lime nitrogen experiments, studies were conducted of the influence of admixtures of manganese and iron compounds and of the time and depth of the application on the fertilizing action of lime nitrogen. These showed that admixtures of manganese and iron had no special influence on the action of lime nitrogen. There was no apparent advantage in either deep or shallow

applications or in applications at short or long times before planting. Granulated lime nitrogen gave good results with wheat and oats, but in the average of all cases the nitrogen of lime nitrogen was not so effective as that of ammonia fertilizers.

Pot experiments with urea, urea nitrate, calcium nitrate, ammonium chlorid, sodium ammonium nitrate, potassium ammonium nitrate, and so-called Burkheiser salt with different soils and crops are also described. With a few exceptions, these new nitrogenous fertilizers gave as good as, or better results than, ammonium sulphate. The ammonium chlorid especially gave good results.

Tests of the fertilizer value of ammonium bicarbonate on wheat, mustard, barley, potatoes, and beets showed that the nitrogen of the bicarbonate was utilized about as well as that of ammonium sulphate in both pot and field experiments, except in the case of beets. However, the sugar content of the beets was greater with ammonium bicarbonate than with ammonium sulphate. Ammonium bicarbonate lost nitrogen normally, and considerably more when added to soil with caustic lime or when added to limed soils. It is concluded that this material must be stored under dry and air-tight conditions.

The nitrogenous fertilizers ammonium sulphate, nitrate, and urea, J. KUYPER (*Arch. Suikerindus. Nederland. Indië, 31 (1923), No. 2, pp. 21–25*).—Experiments on heavy clay and tough light clay soils growing cane, to compare ammonium sulphate nitrate with ammonium sulphate, are briefly reported. These showed that the ammonium sulphate nitrate is about as effective a source of available nitrogen as ammonium sulphate. However, the ammonium sulphate nitrate has the disadvantage of being excessively hygroscopic and in the Java climate becomes almost a liquid.

Further experiments to compare urea with ammonium sulphate showed on a limited scale that there is little difference between them as sources of available nitrogen. However, the hygroscopic properties of urea and the fact that it leaches quite readily are not in its favor for use on Java soils.

The value of ammonium chlorid as a nitrogenous fertilizer, J. KUYPER (*Arch. Suikerindus. Nederland. Indië, 31 (1923), No. 1, pp. 1–4*).—Comparative experiments on different Java cane soils are briefly reported showing that ammonium chlorid gave about as good results as ammonium sulphate, both as regards increased crop yields and retention by the soils. It is concluded that ammonium chlorid may be used as a substitute for ammonium sulphate on Java cane soils.

Basic slags and rock phosphates, G. S. ROBERTSON (*Cambridge: Univ. Press, 1922, pp. XVI+112, pls. 8, figs. 29*).—This book is one of the Cambridge Agricultural Monographs, with a preface by E. J. Russell. Its main purpose is to record the results of the field experiments with rock phosphates and open-hearth basic slags conducted in Essex, England, during the period from 1915 to 1920. These included field experiments on bowlder clay, London clay, and chalk soils on which grass was grown. The experimental plats were ¼ and ⅕ acre in area. The basic slags used included basic Bessemer slag and basic open-hearth slag with and without the addition of fluorspar. These were compared with Florida pebble, Florida soft, Tunisian, Algerian, Gafsa, and Egyptian rock phosphates, Cambridge corprolites, and a ferruginous Cleveland phosphate.

With two exceptions, the field experiments showed a marked response to phosphates. It is considered to be quite apparent that good results can be expected on both the London clay and bowlder clay soils from the various types of rock phosphates, and that, considered over a period of four or five years, it is reasonable to expect these phosphates to give results approximately equivalent to those secured from the highly citric-soluble types of basic slag.

Seasonal differences, however, were apparent, which suggested that the rock phosphates require a considerably higher rainfall to produce the maximum effect than is the case with the highly soluble slags. During dry seasons highly soluble basic slag gave considerably better results. The results indicated further that, on sour soils well supplied with organic matter and situated in districts with a moderately high rainfall, rock phosphates may give even superior results to those secured from basic slag. Open-hearth fluorspar basic slags were found to be very uncertain in their action. While they effected considerable improvement, the less soluble types proved to be less effective than either the highly soluble slags or the rock phosphates.

The results as a whole are taken to indicate that rock phosphates will prove almost as effective as the best grades of basic slag for root crops where the growing period continues well into the autumn, and that in the northern and western parts of the country, where the grain harvest is late and the rainfall high, rock phosphates of the North African type may reasonably be expected to prove a suitable substitute for the high-grade basic slags of the past.

An investigation into the reason why basic phosphates have caused increased yields is also reported. This included studies of the effect of phosphates on the botanical composition of the herbage, on the moisture content, temperature, and texture of the soil, on the accumulation of nitrates in grassland, and on soil bacteria. The bacterial analyses from all the experimental fields agreed in showing that, as far as quality of the herbage is concerned, there is no difference between the effectiveness of rock phosphates and that of highly citric-soluble basic slags. There were, however, indications that the open-hearth fluorspar slags of very low solubility are less efficient in this respect than the highly soluble basic slags.

The results in general apparently indicate that basic slags have a tendency to improve moisture and temperature conditions in the soil, probably by stimulation of the plants through their roots and obviously not by any marked improvement in the soil structure. The slags also seemed to improve nitrate accumulation, although no uniform stimulation of nitrate bacteria was evident.

Further studies reported dealt with the factors limiting the yield of hay and the action of phosphates on heavy clay soils. The results are taken to indicate that on these soils, after the phosphate requirement has been met, rainfall is the limiting factor for the hay crop, and that potash is the second limiting manurial factor.

A final study deals with the action of basic slag on the acidity of soil as measured by the lime requirement and H-ion concentration. The conclusion is drawn that continued applications of heavy dressings of basic slag over intervals of three years do not suffice to supply the lime requirement of heavy clay soils under grass. On the contrary, the results indicated that such soils are liable to become even more sour than similar soils left untreated.

Experiments with Schroeder's potassium phosphate, E. Haselhoff (*Landw. Vers. Sta., 100 (1922), No. 1–2, pp. 31–36*).—Laboratory and field experiments on loam and loamy sand soils with barley, oats, and wheat to determine the fertilizing value of the phosphoric acid of so-called Schroeder's potash phosphate are described. This phosphate is a product of the heating of a mixture of raw phosphates and mineral chlorids. Carnallite has been used for this purpose, thus accounting for the potash content of the product.

It was found that, while this phosphate did not give as good results as Thomas meal, its use resulted in considerably larger yields than were obtained from the checks. Other experiments showed that the potash content of this material was utilized as well as that from the Stassfurt salts. It is concluded that under

the present phosphate shortage Schroeder's potash phosphate is a very valuable substitute.

Probable cause of the toxicity of the so-called poisonous greensand, J. W. KELLY (*Jour. Agr. Research [U. S.], 23 (1923), No. 3, pp. 223–228, pls. 3*).—Studies conducted by the U. S. D. A. Bureau of Plant Industry of the cause of the toxicity of so-called poisonous greensand from the neighborhood of Courtland, Va., are presented. These greensands were analyzed and compared with nontoxic greensands from Redbank, N. J., and Newcastle, Va.

The glauconite element from each of the three deposits of greensand studied was found to be toxic to corn seedlings. The toxicity was due to the presence of iron, aluminum, and manganese in forms readily soluble in weakly acid media. The presence of lime prevented the toxic elements from going into solution, and the addition of lime to the toxic Courtland greensand inhibited its toxic effects. It is stated that deposits of greensand like those at Newcastle, Va., and at Redbank, N. J., naturally contain lime in the form of shell marl in sufficient quantities to prevent the solution of the toxic elements.

The value of by-product lime from sulphate cellulose factories as a fertilizer and soil ameliorant, H. VON FEILITZEN (*Meddel. Centralanst. Försökov. Jordbruksområdet, No. 237 (1922), pp. 25, figs. 7*).—This publication discusses the sulphate cellulose industry in Sweden, and reports chemical analyses of average samples of by-product lime from 4 different factories and the results of germination and vegetation experiments with barley and mustard to determine the value of by-product lime from 3 different factories. It is stated that the 26 sulphate cellulose factories in Sweden have an annual production of by-product lime of about 108,000 tons, corresponding to about 54,000 tons of calcium oxid, and that there is on hand about 321,000 tons, corresponding to about 160,500 tons of calcium oxid.

The chemical analyses showed that the by-product lime from the 4 different factories contains calcium carbonate in the water-free form, varying in amount from 69 to 90 per cent. The calcium hydroxid content varied from 2 to 11 per cent and that of calcium sulphate from 0.03 to 1.67 per cent. Other materials in the by-product lime occurring in varying quantities were calcium thiosulphate, sulphur as sulphids, and sodium hydroxid. The water content of the by-product lime which had been stored for a long time varied between 18 and 42 per cent.

It is concluded from these analyses that this material is not injurious to crops. This conclusion was confirmed by the results of the cropping experiments with barley and mustard. Similar results were obtained with the by-product material as with ordinary slaked lime. Owing to the unfavorable physical conditions of this material, certain processes for reducing it to a more favorable condition are recommended, among which is allowing it to freeze through the winter.

Sulphur as an important fertility element, C. O. SWANSON and W. L. LATSHAW (*Soil Sci., 14 (1922), No. 6, pp. 421–430*).—Studies conducted at the Kansas Experiment Station on the sulphur content of 96 soils from different parts of Kansas, some cropped to grain, some to alfalfa, and some in virgin sod, are reported, and the method of using magnesium nitrate for determining sulphur in soil is described.

The loss of sulphur in soils cropped to grain in the eastern or humid section of the State was found to be proportionate to the loss in nitrogen. In the central and western parts of the State the loss, if any, was small. The amount of sulphur removed from the soil was apparently not compensated for by the amount added in rain. The sulphur lost was found to be greater than the loss of phosphorus, and it is concluded that if sulphur continues to be lost

from the soils in greater amounts than it is supplied it will become a limiting factor in crop production.

The oxidation of selenium by a new group of autotrophic microorganisms, J. G. LIPMAN and S. A. WAKSMAN (*Science, 57 (1923), No. 1463, p. 60*).—In a contribution from the New Jersey Experiment Stations, it is stated that a new group of autotrophic organisms has been found, which are able to derive their energy from the oxidation of selenium. In experiments, a small quantity of selenium mixed with fresh soil was slowly oxidized with an increase in soil acidity. When some of this soil was added to a culture medium consisting of inorganic materials with elementary selenium as the only source of energy, the medium became cloudy within a few days. There appeared in it a minute rod-shaped bacterium capable of oxidizing selenium to selenic acid.

Experiments with soil stimulants, E. HASELHOFF, K. FLUHRER, and F. HAUN (*Landw. Vers. Sta., 100 (1922), No. 1–2, pp. 59–78*).—Laboratory and field experiments with several crops on different soils to determine the stimulating influence of different compounds of manganese, sulphur, and lead on crops are reported. These showed that the three elements exercised no constant favorable influence upon crop growth and in many instances caused injury. The assimilation of plant nutrients by crops decreased where these stimulants were used, especially in sand soil.

Fertilizing value of volcanic ash, R. GUILLIN (*Jour. Agr. Prat., n. ser., 38 (1922), No. 52, pp. 583, 584*).—Analyses of two samples of volcanic ash obtained during June, 1922, from the Santa Maria Volcano in Guatemala are presented and briefly discussed. It is noted that there is a variation in the fineness and chlorid content of samples of ash discharging from the volcano at different times. While the total phosphoric acid and potash contents are apparently not very large, the percentage of availability is considered to be relatively high. It is estimated that in the neighborhood of the volcano these ash deposits amount to around 11,000 kg. per hectare (9,790 lbs. per acre) at more or less regular intervals. In view of their nutrient content these ashes are considered to be of considerable fertilizing value to sugar cane crops.

The value of cachaza as a fertilizer, J. H. RAMÍREZ (*Porto Rico Dept. Agr. and Labor Sta. Bul. 31 (1922), Spanish ed., pp. 5–32, pls. 2*).—This report contains chemical analyses and the results of fertilizer, ammonification, and nitrification tests of cachaza or filter press waste to determine its value as a fertilizer. This material is composed principally of water, sugar, bagasse, nitrogenous organic matter, some mineral material, and phosphoric acid.

It was found that cachaza compares favorably with rich stable manure as a fertilizer when it has been treated with some lime. The good results from this material were perceptible during the second and third years after its application. It apparently exercised a physical as well as a chemical improvement in the soil owing to its content of organic matter. The ashes of cachaza were also found to be of considerable fertilizing value, owing particularly to their content of soluble potash.

It is stated that the quantity of cachaza produced in Porto Rico during 1920 was about 30,152 tons of the dry material, which is considered to be worth about $9.16 per ton on the basis of its content of fertilizing materials. Approximately 12,910 tons of cachaza ashes were also produced on the island in 1920, which are valued at $42,216 on the basis of their potash content.

Testing fertilizers for Missouri farmers, 1922, L. D. HAIGH (*Missouri Sta. Bul. 200 (1923), pp. 51, fig. 1*).—This bulletin contains practical information and advice on the selection, purchase, and use of fertilizers in Missouri, and presents the results of actual analyses and guaranties of 329 samples of fertilizers and fertilizer materials, representing 148 different brands, and the

results of tests of 683 samples of limestone collected for inspection in Missouri during 1922. A list of brands of fertilizers and their guaranteed analyses as registered and offered for sale in Missouri for 1923 is also included.

AGRICULTURAL BOTANY.

[Work of the] department of genetics, C. B. DAVENPORT ET AL. (*Carnegie Inst. Wash. Yearbook 20 (1921), pp. 101–122, 152, 153, figs. 2*).—In these sections of the report the organization of this department is discussed in connection with its work during the year, including studies demonstrating the close relationship between variations in chromosome number and specific variation in the form and other body characters.

The work on *Datura stramonium* is regarded as offering remarkable explanations of the complexities of De Vriesian mutation, a form possibly not less significant than Mendelian mutation. The facts and results herein reported are derived partly from studies with animal forms.

The search for genetically simpler material for use in study than *Oenothera lamarckiana* has demonstrated suitability in *D. stramonium*, a program of work on which plant has been inaugurated. A preliminary report by Blakeslee, Belling, and Farnham has been noted (E. S. R., 44, p. 327).

The specificity of the different chromosomes of Datura is a matter of great importance for the analysis of the unbalanced chromosome types. Though these 12 chromosomes look much alike, prolonged study shows them to fall into six grades of size, 1 largest, 4 large, 3 large medium, 2 small medium, 1 small, and 1 smallest. Other groupings are described.

A beginning has been made in the determination, in trisomic mutants, of the average numbers of microcytes with eliminated chromosomes and also the numbers of double-sized pollen grains with a double number of chromosomes.

Cooperative work on Datura mutants is indicated. A study has been made of causes of sterility, in particular abortion of pollen grains. Studies by Blakeslee, attempting to deal with the problems of sex and exemplifying the bread mold (Rhizopus) which behaves as if sexually differentiated, are still being pursued.

The inheritance of special traits was studied in Rudbeckia and in Portulaca. Preliminary observations at Sacaton, Ariz., in 1920 indicated that Egyptian and Upland cotton differ in their sap properties. Careful plantings were made at the cooperative testing station at Sacaton for the purpose of a more exact comparison of Meade and of Acala Upland cotton with Pima Egyptian cotton, and of the F_1 hybrid between Pima and Meade with the two parent species.

Studies on the physico-chemical properties of vegetable saps include the problem of the adjustment of parasitic plants to the conditions presented by the host, physico-chemical properties of the tissue fluids of alpine and subalpine vegetation, physico-chemical properties of coastal vegetation, and physico-chemical properties of the tissue fluids of cereals under irrigation and under dry-farm conditions.

Origin of mechanism of heredity, M. C. COULTER (*Bot. Gaz., 70 (1920), No. 6, pp. 459–464*).—The present paper reviews the hypothetical relations of certain by-products alleged to be retained during the individual and phylogenetic history of a typical organism, outlining the origin of the antibodies which are supposed to isolate (by a sort of insulation) such retained by-products and, in general, the program as hypothetically carried out by the primitive hereditary mechanism, leading to the appearance of determiners which are to be visualized as by-products of metabolism, chemically active substances. The reaction system, which arises as the result of an inevitable sequence of

events, determines what general type of reaction shall take place at a given phase in the life history. The by-product merely decides which of a number of possible reactions within this general type shall be the one chosen.

The origin of a given by-product is accounted for by chance environmental conditions. This may well have been the external environment in the case of the simpler organisms, but must be the internal environment in the more complex. This seems also to provide sufficient basis to explain the small degree of inheritance of acquired characters that has been said to take place.

A study of partial sterility in certain hybrids, E. M. East (*Genetics, 6 (1921), No. 4, pp. 311–365, figs. 17*).—The work here outlined with discussion, as carried on over a term of years, is said to extend certain conclusions previously reached by East and Hayes (E. S. R., 27, p. 428).

In the present paper a series of crosses between various species of Nicotiana are discussed from the standpoint of their behavior as first-generation hybrids. Vigor of heterosis is seen to accompany hybridization far beyond that point of difference between the species entering into the combination which produced sterility. Then came a degree of difference which accompanied a sudden drop in vigor to a point below that of either parental type. The conclusion is that at a certain point differentiation in gametic structure is so great that the reduction division with the formation of all the possible types of gametes does not take place in the normal manner, through ontogeny may go on normally at this point of differentiation. With a still greater differentiation in gametic structure even ontogenetic cell division does not proceed in the usual manner, and a marked lowering of vigor occurs.

The suggestion is offered that the gametes eliminated are those in which chance has thrown together such a nearly balanced lot of chromatin of different constitution that proper reorganization in preparation for their essential gametic functions is impossible. The evidence of the pedigree cultures is said to bear out this view. Other inductions are outlined as made from the behavior of the cultures.

A conclusion of practical significance is that not only these experiments but other critical experiments on plants indicate that the greatest opportunity for plant improvement (and possibly for animal improvement) lies in crossing together types which have become as far differentiated from each other as is possible without producing complete sterility in the hybrids. When species differing in a large number of allelomorphs can be crossed, and the resulting hybrids are completely fertile, there is a remarkable chance for desirable recombinations occurring in the F_2 generation.

It is believed that just those families and genera that have varied widely in nature, yet have retained that necessary physiological compatibility which allows them to cross and to produce more or less fertile hybrids, are the only ones that have been really important as domestic plants and animals. Some of the genetic evidence and most of the historical evidence relating to the important cultivated species indicate a polyphyletic origin. It is believed that the desirability of a type for domestication varies directly with the amount of physical variation and inversely with the amount of sexual incompatibility accompanying such variations.

Cytological studies on cereals.—III, Chromosome number variations in species hybrids of Triticum, H. Kihara (*Bot. Mag. [Tokyo], 35 (1921), No. 410, pp. 19–44, pl. 1, figs. 2*).—Data and discussion are presented regarding studies by the author on chromosome number variations in *Triticum* spp., with illustrative parallels from other workers, and based chiefly on material obtained from studies on species hybrids of Oenothera.

A genetico-physiological study on the formation of anthocyanin and brown pigments in plants, I. NAGAI (*Jour. Col. Agr., Imp. Univ. Tokyo, 8 (1921), No. 1, pp. 1–92, pl. 1, figs. 2*).—The present paper deals with the result of an investigation carried out in order to discover what relation exists between anthocyanin and brown pigments, and what observations can be made with regard to the physiological action of the genes which are analyzed by the breeding experiments for the characters in which those pigments are concerned.

In a number of species of plants examined two groups of pigments, anthocyanins and the reddish-brown pigments, can be traced to the chromogenic substances previous to their formation. In certain cases both of the pigments can be formed from the same chromogenic substance by the action of various complementary pigment-yielding agencies. The chromogenic substances can be identified to two groups of allied substances, one of which is designated as the chromogenic substance *F*, which includes the glucosid of certain flavones and flavonols, and the other the chromogenic substance *P*, of which the chemical nature is yet unknown. Evidence is offered that certain brown and reddish-brown pigments are the oxidation products of the chromogenic substances *P* and *F*. Certain anthocyanins are completely decolorized by the action of oxidizing enzyms, which also cause certain flavones, flavonols, and their glucosids to yield a characteristic oxidation color. The formation of the pigments, as well as the chromogenic substance, is entirely or partially suppressed by the action of dominant inhibitors. Certain genetic phenomena relating to the colors of the seed coat are studied. The characters studied, arranged according to dominancy in ascending order, include blue tinged green>blue tinged yellow>green>yellow>black>brown (lighter brown>reddish brown)>buff.

The osmotic concentration and electrical conductivity of the tissue fluids of ligneous and herbaceous plants, J. A. HARRIS, R. A. GORTNER, and J. B. LAWRENCE (*Jour. Phys. Chem., 25 (1921), No. 2, pp. 122–146, figs. 4*).—A fuller account, including tabular and graphical details, is given of investigations previously noted (E. S. R., 47, p. 327).

Studies indicated as carried on in the Arizona deserts, in the Jamaican montane rain forest, and in the mesophytic habitats of the north shore of Long Island have shown that the osmotic concentrations, as measured by the cryoscopic method, is far higher in the leaf tissue fluids of ligneous than of herbaceous species. A large series of determinations in the various nonhalophytic habitats of the north shore of Long Island shows that the specific electrical conductivity of the expressed leaf tissue fluids of ligneous species is lower than that of herbaceous species. This shows that while the concentration of ionized electrolytes is lower in ligneous than in herbaceous forms, the reverse is true for total solutes.

Studies in the physiology of the fungi.—XIV, Sulphur nutrition: The use of thiosulphate as influenced by hydrogen-ion concentration, G. M. ARMSTRONG (*Ann. Missouri Bot. Gard., 8 (1921), No. 3, pp. 237–281, figs. 21*).—In continuation of reports previously noted (E. S. R., 46, p. 324), it is stated that $MgSO_4$, $Na_2S_2O_3$, $MnSO_4$, KSH, $KHSO_3$, $K_2S_2O_8$, KCNS, and NH_4CNS, in general, have served as favorable sources of sulphur, in the order named, for *Aspergillus niger*, *Penicillium glaucum*, and *Botrytis cinerea*. Slight growth was obtained with K_2S. Inhibition of growth occurred for Penicillium on $K_2S_2O_8$, though this compound was better for Aspergillus, in the concentration employed, than KSH or $KHSO_3$.

H_2S has been produced except where $MnSO_4$, $MgSO_4$, and $K_2S_2O_8$ were used. The production of this compound seems unrelated directly to H-ion concentration, concentration of the salt, or relative degree of growth.

In the culture solution, sulphates appear as the chief end product of the action of the above-named fungi on $Na_2S_2O_3$, H_2S is generally produced, molecular sulphur in visible quantity not infrequently appears, the tetrathionate has been identified in certain cases, and in the hyphae globules of sulphur sometimes occur.

The ratio of thiosulphate decomposition to growth is not a constant in all cases for *A. niger*, *P. cyclopium*, and *B. cinerea*, though in the 12 series of cultures here reported upon such a constant relation does appear with one or more of the fungi in eight of the series. The usual growth range of H-ion concentration does not appear to be a limiting factor in the efficiency of the thiosulphate as a source of sulphur for these fungi.

In a modified Pfeffer solution the disappearance of the sugar, within the limits determined, marks the point of the reversion of reaction for *A. niger*. *P. cyclopium*, on the other hand, may cause a reversion of the reaction with sugar present in the solution.

Since it has been established that reversion of the reaction may occur, it is clear that the true course of the changes which have occurred may not be obtained merely by a determination of the initial and final H-ion concentrations of the fungus cultures.

Effect of zinc and iron compared with that of uranium and cobalt on growth of Aspergillus, R. A. Steinberg (*Bot. Gaz., 70 (1920), No. 6, pp. 465–468*).—As shown in contributions previously noted (E. S. R., 41, p. 746; 43, p. 130), treatment of the Pfeffer nutrient solution with calcium carbonate at an elevated temperature removes from the solution the last traces of iron, zinc, and probably the other heavy metals to a high degree. The Pfeffer solution so treated also supports but a minimal growth of *A. niger*, while the addition of both iron and zinc salts results in a phenomenal increase in growth as measured by the dry weight formed. The author now notes that the evidence presented, while showing that the presence of zinc in the cultural solution is as necessary for *A. niger* as the presence of iron, did not include the action of other heavy metal salts, and presents in the present account data obtained by the use, in this connection, of $Co(NO_3)_2+6H_2O$ and $UO_2(NO_3)UO_2(NO_3)_2+6H_2O$, both Kahlbaum reagents, by methods previously described.

These studies, it is held, must be regarded as confirmatory of the view that both iron and zinc are essential for the growth of *A. niger*. The assumption must be made that when iron and zinc are present in favorable amounts a partial replacement of either or both of these elements can occur by the so-called chemical stimulants.

Afterripening and germination of apple seeds, G. T. Harrington and B. C. Hite (*Jour. Agr. Research [U. S.], 23 (1923), No. 3, pp. 153–161*).—The authors give an account of investigations on the effect of storage conditions, including the presence or absence of the seed coats and inclusion within or removal from the fruit, on afterripening and germination of apple seeds.

When taken from the apples at their maturity apple seeds are said to be incapable of germination. The dormancy is resident in the embryo, and etherization or the use of alternating temperatures will not bring about germination. Apple seeds acquire the power to germinate in a few months when kept moist at a temperature between 5 and 10° C. They also afterripen within the fruit in commercial cold storage at 0° or in a cold cellar, but they do not afterripen in dry storage or when kept moist at 20° or at a higher temperature. The removal of the outer seed coat had no apparent effect on completely dormant apple seeds, although the removal of the outer or both seed coats accelerated the germination of afterripened seeds.

The authors state that the commercial practice of layering apple seeds out of doors over winter is not necessary to bring about their complete afterripening and germination.

Factors influencing catalase activity in apple leaf tissue, A. J. HEINICKE (*New York Cornell Sta. Mem. 62 (1923), pp. 5–19*).—The results are given of a study of some of the factors which influence catalase activity in apple leaf tissue and the nature of the catalase found in the tissues of apple leaves.

A method is described for preparing tissues for catalase tests, and the details of the determinations are given.

Catalase activity is shown to be easily influenced by factors that affect also the nutritive or physiological conditions of the tissue. Treatments that tend to cause an actual or relative increase in the nitrogen content of apple leaves in many cases bring about an increase in catalase activity, while conditions causing a relative increase of carbohydrate material apparently produce a reduction in catalase activity.

Catalase tests were made in studies on fruit setting and fruit bud development, and the preliminary results of such tests are said to be very suggestive as to the indicator value of catalase as expressing the nutritive condition of the plant.

Structure, physical characteristics, and composition of the pericarp and integument of Johnson grass seed in relation to its physiology, G. T. HARRINGTON and W. CROCKER (*Jour. Agr. Research [U. S.], 23 (1923), No. 3, pp. 193–222, figs. 10*).—Investigations were undertaken in the hope of explaining some features of the behavior of Johnson grass seeds during their initial dormancy, their period of afterripening, and their germination.

It is claimed that Johnson grass seed is markedly dormant when first matured under ordinary conditions of storage. The seed requires a number of months for complete afterripening, and even when fully afterripened will not germinate completely except with the use of alternating temperatures in a very warm temperature range. Seeds of the closely related Sudan grass were found to germinate freely with a wide range of temperature either constant or alternating and without the intervention of any considerable period of afterripening. It is believed that the character of the coverings of Johnson grass seed limits the imbibitional swelling of the embryos, and thus keeps their water content below the minimum required for the inception of germination at relatively low and constant temperatures.

[Studies on] ecology (*Carnegie Inst. Wash. Yearbook 20 (1921), pp. 389–411*).—The work of the year is briefly indicated in special reports, some of which are noted below.

Slope exposure studies, F. E. Clements, D. Lutjeharms, and T. J. Fitzpatrick (p. 391).—The opposed slopes of Engelmann Canyon at the Alpine Laboratory are being investigated with reference to the factor differences of north and south exposures, and the correlation of function, growth, and vegetation with the effective factors. The factor results obtained indicate that the two slopes are more nearly similar in air than in soil conditions.

Relation of bud to trunk growth in conifers, J. V. G. Loftfield (p. 392).—Dendrographs were again installed in the spring on the trunks of *Picea engelmanni, Pseudotsuga mucronata,* and *Pinus ponderosa,* in cooperation with MacDougal, the data from which are briefly discussed.

The significance of transpiring power, R. J. Pool (pp. 392, 393).—An investigation has been undertaken to determine whether there is any regular correlation between the leaf structure of plains plants and the so-called transpiring power, as indicated by the refined cobalt-paper method. It is thought that the transpiring power may furnish a means of measuring habitat differentiation.

The rôle of soil air in hydrophytic habitats, Clements and G. W. Goldsmith (pp. 393, 394).—In resuming investigation of this study, attention has been directed chiefly thus far to swamps and bogs and to wet soils generally, though it is planned to deal with the soil air of cultivated as well as natural soils, and to devote especial attention to the relation of soil air to acidity and to the toxins of both bogs and agricultural soils.

Photosynthetic efficiency, Clements and F. Long (p. 394).—It has been found desirable to check the method of determination of photosynthate present in killing leaves by the direct measurement of photosynthesis in the field, for which purpose a portable field apparatus has been devised and improved.

Experimental pollination, Clements and Long (pp. 394, 395).—Four major lines of study have received particular attention, namely, the life history of the flower, normal pollination, experimental pollination, and competition for pollinators. Apparently each species of pollinator has a preferred flower which is visited almost exclusively during its prime.

Experimental taxonomy, Clements and H. M. Hall (pp. 395, 396).—During the summer of 1921 attention was given chiefly to following the development of transplants already made, though a number of alpine and plains species were moved into the montane gardens. While too early to expect considerable changes in most of the transplants, some of them have already undergone extensive modification.

Statistical studies, Hall (p. 397).—Attention has been given to quantitative methods in connection with certain genera with a view to determining the amount of intergradation between forms and the degree of difference where intermediate stages are now wanting. The results have been used chiefly in arriving at conclusions regarding relationships.

Rubber plants, Hall and Long (pp. 398, 399).—Studies have been continued on the rubber content of native North American rubber plants, as also upon the life histories of a few of the more promising species. Ten species are considered as worthy of further study, *Asclepias subulata* and *A. sullivanti* among these being of special promise. Other plants are to be studied.

Origin and nature of laticiferous tissue, Long (p. 399).—In connection with the studies on rubber plants an extensive investigation has been begun of the histology and chemistry of laticiferous tissue in various groups, as Euphorbiaceae, Asclepiadaceae, and Cichorieae.

Root development and absorption in crop plants, J. E. Weaver, F. C. Jean, and J. W. Crist (pp. 399, 400).—Life history studies of root development have been made at three or more periods in the growth of crops at Peru and Lincoln, Nebr., Phillipsburg, Kans., and Burlington, Colo. The root extent varies but slightly from year to year. The lateral root spread in drier solids is marked, as is especially their development near the surface.

Experiments have been carried out with barley, potatoes, corn, and native grasses to determine the absorption of water and nitrates at different levels during growth. The results show that crops absorb water at all levels to which roots penetrate, and barley, for example, in quite as large amounts from deeper as from surface soils. Similar results are indicated as regards nitrates.

Plant production quadrats, Weaver (pp. 400, 401).—The study of the effect of climate upon the production of natural vegetation, began in 1920, has been continued as here briefly indicated. The results thus far obtained with mixtures of the dominants indicate a fairly direct correlation between the chresard and plant production.

The relation of hardpan to root development, Weaver and Crist (p. 401).—During the excavation of the root systems of native and crop plants in the prairie and plains associations during the past five years, hardpan has been found in more than 30 localities. This has been studied, and it is thought that the chief effect of hardpan upon root development lies in its reduction of water penetration, although when thoroughly moist it becomes quite mellow.

Transplant quadrats and areas, Clements and Weaver (pp. 401, 402).—The studies in experimental vegetation, carried on for the previous three years and greatly extended during 1921 are briefly described.

Climax formations, Clements (pp. 402, 403).—All of the climax formations and associations of the West have received some study during the year. The most striking discovery was to the effect that the short-grass plains are not a natural community but an artificial one produced by overgrazing.

Grazing research, Clements and Loftfield (pp. 407, 408).—Studies of the effect of grazing on the carrying capacity of ranges, the structure of grassland communities, the competition of grasses and shrubs, and its relation to indicator plants have again been made throughout the West. These have confirmed the view that grazing has profoundly modified the grasslands of arid regions, and has led to their replacement by sagebrush and desert scrub over wide areas. Experiments have been begun to determine the best methods of reseeding overgrazed ranges, and to determine the relative importance of water and temperature in germination and establishment, as well as in growth. The results indicate provisionally that water is the controlling factor.

Climatic cycles, Clements and A. E. Douglass (p. 409).—In continuing the investigation of climatic cycles by means of the annual rings of trees, sections have been collected from the redwood at Santa Cruz, Calif., from pines in the Santa Rita Mountains of Arizona, and from the white pine in eastern Massachusetts. In addition, material was obtained from other sources and studied.

A preliminary analysis of the cyclic nature of rainfall in the western United States has shown not only that critical drought periods since 1835 have coincided with sun-spot maxima, but also that such periods have always occurred when maxima reached a certain degree of intensity.

Biotic succession in Bad Lands, Clements (p. 410).—Some evidence has been obtained to indicate that the erosion cycles of Bad Lands correspond to climatic cycles. It has become fairly clear that practically all Bad Lands owe their origin or their persistence to aridity, and that they are thus indicators of arid climates.

Morphology and biology of the Actinomycetes, R. Lieske (*Morphologie und Biologie der Strahlenpilze (Actinomyceten). Leipzig: Borntraeger Bros., 1921, pp. IX+292, pls. 4, figs. 112*).—Systematic treatment is applied to the Actinomycetes as regards their characters and their wide range of relations, also their morphology, physiology, and special pathology in connection with man, animals, and higher plants.

The bacteria of leguminous nodules, P. Denier (*Rev. Bot. Appl. et Agr. Colon., 1 (1921), No. 1, pp. 24–29*).—An account of experimentation and opinion concludes that the continued culture of nodule bacterial in the same soil is not only possible but recommendable, the organism being thus kept in typical form and in the condition most favorable to its conservation and effectiveness.

The bacteria of leguminous nodules are divisible into two groups at least, the first showing the characteristics of *Bacillus radicicola* and the second being monoflagellate.

FIELD CROPS.

Productive farm crops, E. G. Montgomery (*Philadelphia and London: J. B. Lippincott Co., 1922, 3. ed., rev., pp. XIX+519, pls. 17, figs. 198*).—A third and revised edition of a work noted earlier (E. S. R., 41, p. 331).

[Field crops work in Tunis, 1919–1921], F. Bœuf, L. Guillochon, and Gery (*Dir. Gén. Agr., Com., et Colon. [Tunis], Bul., 26 (1922), No. 110, pp. 414–440, 463–478, pl. 1*).—Varietal trials with wheat, barley, oats, flax, legumes, and forage crops, and fertilizer tests with wheat are described (E. S. R., 45, p. 735), together with notes on the growth periods and drought and rust resistance of a number of native and exotic wheat varieties.

[Report of field crops work in Nigeria, 1920 and 1921], A. H. Kirby and O. T. Faulkner (*South. Provs., Nigeria, Agr. Dept. Ann. Rpt., 1920–21, pp. 7–14; Nigeria Agr. Dept. Ann. Rpt. 1921, pp. 2–4, 6*).—The continuation of earlier work (E. S. R., 44, p. 827; 46, p. 437) is described.

[Report of field crops work in Punjab, India], D. Milne et al. (*Punjab Dept. Agr. Rpt. 1921, pt. 2, pp. 1–16, 18–39, 42–51, 68–74, 75–113, 115–123, 125–145, 147–157, 158–163, 165–169, pls. 6*).—The progress of earlier work (E. S. R., 46, p. 634) is reported.

The LeBeau alfalfa, J. F. Cox (*Michigan Sta. Quart. Bul., 5 (1923), No. 3, pp. 113–115*).—Practically all of the alfalfa seed produced in Monroe County, Mich., 3,000 to 4,000 bu. in 1920, 5,000 in 1921, and over 8,000 bu. in 1922, can be traced to alfalfa originally grown by Clement LeBeau, and first harvested for seed 37 years ago. LeBeau alfalfa from Monroe County slightly outyielded common alfalfa from Montana and other northwestern States at the station. The LeBeau seed is produced largely on old lake bed soils, and yields averaging 2.5 bu. per acre are reported.

Make alfalfa a sure crop, R. A. Moore and L. F. Graber (*Wisconsin Sta. Bul. 349 (1922), pp. 24, pl. 1, figs. 23*).—The merits of new seedings in reducing winterkilling, hardy strains for durable stands, liming, inoculation, early renewal of nurse crops, favorable soil conditions and culture, enough seed, mixing alfalfa with timothy and clover, and the proper cutting stage are pointed out and illustrated as factors in making alfalfa a sure crop in Wisconsin (E. S. R., 42, p. 632). Suggestions for growing alfalfa on sandy soil are included, with notes on seed production.

Nitrogenous fertilizers on alfalfa, P. Wagner (*Mitt. Deut. Landw. Gesell., 38 (1923), No. 4, pp. 49–51*).—The results of three years of pot and plat tests showed that nitrogenous fertilizers did not increase the nitrogen content of alfalfa hay. In the few cases where the hay yields were enhanced the increase did not pay for the fertilizer.

Report on the relation of the nitrogenous matter in barley to brewing value, H. F. E. Hulton (*Jour. Inst. Brewing, 28 (1922), No. 1, Sup., pp. 33–142*).—An extensive review of research findings on the relations of nitrogen to the size of kernel and the amount and character of the malt extract, and the amount and character of nitrogenous matter in barley to its brewing value points to conclusions summarized as follows:

The factors contributing to the production of barley with a high nitrogen content include too rapid or delayed ripening, a hot and dry season, a thin stand with resulting lack of root competition, too rich or heavy soil, an excessive use of nitrates or nitrogenous fertilizers alone, large and coarse kernels, and the characteristic nitrogen content of the original strain or variety. The qualities usually associated with barley of high nitrogen content are a high rate of tillering, a lower extract in the resulting malt, defective ripening,

steeliness, reduced bushel weight, large kernels and high density, a tendency to heating and heavy loss while malting, slowness in malting and with high nitrogen in the finished malt, a high percentage of noncoagulable proteins in the wort, tendencies to fret and haze and to better head retention in the finished product, and a lower ratio of grain to straw. Most of these attributes are considered undesirable. Before attempting improvement, the breeder should determine the exact qualities desired in barley for malting and brewing and whether such qualities may be defined as Mendelian factors.

Improved Robust beans, F. A. SPRAGG (*Michigan Sta. Quart. Bul., 5 (1923), No. 3, pp. 116–118, fig. 1*).—Improved Robust beans outyielded the original strain (E. S. R., 46, p. 132) and produced 50 per cent more than Early Wonder in a four years' comparison at the station.

Red clover seed consumption in United States, A. J. PIETERS (*Seed World, 13 (1923), No. 4, pp. 13–15*).—Based upon the winter wheat acreages in May, 1921 and 1922, estimates are given for the total acreages seeded to clover and the clover seed consumed in the United States in the spring of these years. About 127,645,000 lbs. were consumed in 1921 and 135,152,000 lbs. in 1922, as compared with estimated available supplies of 127,456,000 lbs. and 106,358,000 lbs., respectively.

The linkage of certain aleurone and endosperm factors in maize, and their relation to other linkage groups, C. B. HUTCHISON (*New York Cornell Sta. Mem. 60 (1922), pp. 1425–1473, figs. 3*).—Additional evidence is presented on the linkage of aleurone color and waxy endosperm in maize, on aleurone color and shrunken endosperm, and on shrunken and waxy endosperm.

The order of the genes as determined by three-point tests appears to be *C–Sh–Wx* and *I–Sh–Wx*. Coincidence of crossing over in the *C–Sh–Wx* backcrosses was 0.1389 and in the *I–Sh–Wx* backcrosses 0.0865. According to the data presented, *C* and *I* are either allelomorphic or extremely closely linked. If not allelomorphic, *I* is probably to the left of *C*. Tests of different members of the *I–C–Sh–Wx* linkage group with members of each of the other five linkage groups indicate that the former is independent of the latter in inheritance. It is held, however, that the possibility that the *I–C–Sh–Wx* group and one of the other five groups represent end regions in the same chromosome has not been disproved in all cases. A summary of all linkage tests involving members of the *I–C–Sh–Wx* group and those of other groups is tabulated.

Linkage tests with 13 other factor pairs whose position in the chromosome complex of maize is yet unknown are summarized. In all cases these factors have been shown to be independent of the *I–C–Sh–Wx* group.

Corn experiments, 1922, J. F. O'KELLY and R. COWART (*Mississippi Sta. Circ. 47 (1923), pp. 7*).—Paymaster averaging 49.8 bu. per acre, Mosby 47.3 bu., Hastings 46.9 bu., Cockes 46.7 bu., and Tennessee Red Cob 45.9 bu. led varieties of corn tested at the station for 5 years. Paymaster selections or hybrids were outstanding in the 1922 tests of early and late planted varieties on valley land and on hill land. Comparative yields of yellow and white varieties and hybrids are tabulated.

In a comparison of nitrogen carriers on corn, ammonium sulphate gave a better average yield increase than sodium nitrate when both supplied 15 lbs. of available nitrogen per acre, whereas the sodium nitrate produced the greater increase when 30 lbs. of nitrogen was applied. Both salts made higher gains than calcium cyanamid, which gave about the same returns for 15 and 30 lbs. of nitrogen.

The cotton countries, J. HUBBACK (*Les Pays Cotonniers. Rome: Inst. Internatl. Agr., Serv. Statis. Gén., 1922, pp. XI+143*).—Summary accounts are given regarding the production of cotton in each important political division

in the world, together with statistics of yields, acreages, commercial movement, and prices.

Sulphur as a fertilizer for cotton, E. B. Reynolds and A. H. Leidigh (*Soil Sci., 14 (1922), No. 6, pp. 435–440*).—In experiments by the Texas Experiment Station, carried on near Temple, Tex., in 1920, cotton receiving sulphur at the rates of 50, 500, and 1,000 lbs. per acre averaged 375 lbs. of lint per acre, acid phosphate and 400 lbs. of sulphur 359 lbs., acid phosphate alone 260 lbs., and untreated 277 lbs. That receiving 1,000 lbs. of sulphur made a larger vegetative growth and had darker green leaves than on other plats. Where sulphur was applied at rates of 100, 300, and 600 lbs., the yields increased with the amount applied.

Cotton receiving sulphur and lime, alone and in combination in amounts from 500 to 10,000 lbs. per acre, made the maximum yield with 5,000 lbs. of lime. Sulphur, alone, apparently tended to depress the yield. Lime probably alleviated the injurious effect of the heavy sulphur applications by neutralizing the acid formed by oxidation of the sulphur. Sulphur neither prevented nor controlled root rot.

Weather damage tests on cotton (*U. S. Dept. Agr., Off. Rec., 2 (1923), No. 9, pp. 2, 3*).—Experiments by R. L. Nixon indicate that most of the damage to improperly protected cotton is from the moisture absorbed from the ground rather than from direct rainfall. Most so-called country damage can be prevented by putting the bales on timbers and turning them after each rain so they will dry out properly. Compressed cotton did not absorb as much moisture as flat cotton, but the damage was much greater than in flat bales absorbing an equal amount.

Comparative spinning tests of superior varieties of cotton (grown under weevil conditions in the Southeastern States; crop of 1921), W. R. Meadows and W. G. Blair (*U. S. Dept. Agr. Bul. 1148 (1923), pp. 7*).—Fiber from the 1921 crop of Acala cotton grown in Alabama; Lone Star, Mexican Big Boll, and Rowden grown at different points in North Carolina; and typical North Georgia cotton grown in north Georgia, all produced under boll weevil conditions, was tested under identical mechanical conditions in cooperation with Clemson College.

The grades, length of staples, percentages of visible waste, strengths of the yarns, and percentages of average deviation or irregularity of the sizings and strengths indicate that for hard twisted or warp yarns, if placed in order of their merit and attractiveness to a spinner, the varieties tested would rank as follows: Acala and Mexican Big Boll, Lone Star and Rowden, and typical North Georgia. The tests show the desirability, from a spinning standpoint, of fiber produced by purebred strains of superior varieties of cotton over that from commercial seed even when grown in districts with an excellent reputation for character in cotton.

A study of flax and kindred fibers, C. R. Nodder (*Jour. Textile Inst., 13 (1922), No. 9, pp. 161–171, figs. 15*).—The fact that flax and ramie fibers always twist in a clockwise direction when drying, while hemp and jute fibers twist in the reverse direction, is the basis of a convenient method for distinguishing flax and hemp. Microscopic examination of these fibers after treatment reveals a fibrillar structure, the fibrils of flax and ramie being arranged in left-handed spirals, while those of hemp and jute are in right-handed spirals. In some cases, internal spirals with a reverse twist may occur. The drying of the fibers is always accompanied by a twisting up of the component fibrils.

Kikuyu grass in bracken fern country, J. N. Whittet (*Agr. Gaz. N. S. Wales, 34 (1923), No. 1, pp. 24–26, figs. 2*).—Kikuyu grass is reported as an effective smother crop in controlling bracken fern.

Leguminous forages of Brazil.—I, Meibomia (Desmodium), F. C. Hoehne (*Annex. Mem. Inst. Butantan, Secç. Bot., 1 (1921), No. 1, pp. 54, pls. 23*).—This monograph comprises a general discussion of the genus Meibomia and its agricultural value, a synoptic key to Brazilian species, and detailed descriptions of 24 species, with notes on dissemination and forage value.

Third annual report of the Nebraska Potato Improvement Association, edited by H. O. Werner (*Nebr. State Bd. Agr. Ann. Rpt. 1922, pp. 149–299, figs. 26*).—Among the papers presented at the third annual meeting of the association, held at Scottsbluff in December, 1921, were the following: Experimental Results with Potatoes at the Torrington, Wyo., Substation, by A. Christensen (pp. 172–174); Seed Potato Certification in Nebraska (pp. 176–190) and Results of Experiments with Potatoes in Western Nebraska during 1921 (pp. 213–218), both by H. O. Werner; and Results with Potatoes Grown in Thirteen Different Rotations under Irrigation at the Scottsbluff Experiment Farm during the Past Ten Years, by J. A. Holden (pp. 219–224).

Results of rice experiments in 1922, C. F. Dunshee (*California Sta. Bul. 354 (1923), pp. 399–415, figs. 14*).—A progress report on experiments near Cortena, in Colusa County, Calif., during 1922.

Barnyard grass did not appear above the surface in plats submerged 8 in. before or immediately after broadcasting and throughout the season, whereas infestation increased with a decrease in depth. Water weeds other than barnyard grass were not controlled to any extent by continuous submergence. A very inferior stand of rice with a heavy growth of annual sedge resulted where seed was drilled 1.5 in. deep and submerged to the required depth immediately after. Plats submerged 4, 6, and 8 in. when plants were 1 in. high were equally foul with water grass. Early seedings gave distinctly better yields, with little difference being noted in water-grass control. Cat-tails were neither controlled by heavy seeding nor by broadcasting on stubble or in water on rice stubble. Late cutting of cat-tails did not apparently delay growth during the last of the season. Field photographs of nine rice weeds are included.

Studies of the rice soils and irrigation water by P. L. Hibbard indicate that when the land is free of alkali little change is produced in the water by passing over the rice fields, but when the soil contains soluble salts or alkali some of this matter is carried away in the drainage. Rice culture during four preceding years had not evidently yet removed enough of the alkali to make the soil safe for sensitive crops. Investigations on the physical conditions of Willows clay loam, Willows clay, and Stockton clay adobe by C. F. Shaw showed no definite or consistent indication of changes due to the submergence incident to rice culture. The moisture equivalent and the hygroscopic coefficient showed very slight variations. The content of organic matter was fairly uniform throughout all the samples, the total variation being less than 1 per cent. Tests of the volume weight likewise showed no definite change due to rice culture. The Willows clay loam and clay from rice plats contracted much more on drying than did similar soils from pasture, whereas the Stockton clay adobe gave opposite results.

The inheritance of characters in rice, II, F. R. Parnell, G. N. R. Ayyangar, K. Ramiah, and C. R. S. Ayyangar (*India Dept. Agr. Mem., Bot. Ser., 11 (1922), No. 8, pp. 185–208, pls. 5*).—The characters investigated in this further contribution (E. S. R., 40, p. 631) include golden coloring of inner glumes with modifying factors, shape of grain, dwarf habit, and the color relations of red; red, gray-brown, and anthocyanin pigmentation; red and golden; golden and undeveloped grain; purple; and purple and brown. See also a note by Hector (E. S. R., 48, p. 34).

A dwarf plant obtained from Burma is shortened and thickened in all its parts and forms a very stiff, erect clump. The leaf is coarse and rough, much broader than that of any ordinary variety, and quite erect. The panicle is very compact, cigar-shaped, and erect, due to the short, stiff branches being closely pressed together, and the grain is short and rounded. F_1 progeny of a natural cross were normal in every respect, and in F_2 a simple ratio of 3 normal:1 dwarf segregated. Aside from increased vigor, the segregated dwarfs were identical with the dwarf parent.

The soy bean, C. V. Piper and W. J. Morse (*New York and London: McGraw-Hill Book Co., Inc., 1923, pp. XV+329 figs. 84*).—The information concerning the soy bean, accumulated in this volume, is presented from both agricultural and commercial standpoints, and consideration is given the historical and botanical interest. The successive topics include the commercial status of the crop; botanical and agricultural history; culture, harvesting, and storage; composition and utilization; varieties, comprising classification, characteristics, a descriptive key, breeding and improvement studies, and notes on genetic behavior; structure of the seed; soy-bean oil, cake, or meal; soy-bean products for human food; table dishes of soy beans and soy-bean products; and enemies of the soy bean. An extensive bibliography is appended.

The formation of nodules by different varieties of soy beans, E. B. Fred and O. C. Bryan (*Soil Sci., 14 (1922), No. 6, pp. 417–420*).—Laboratory and field studies at the Wisconsin Experiment Station failed to show that the nodule bacteria of soy beans are highly specific, while, on the contrary, bacteria of one variety were found to readily inoculate another variety. Variation in nodule formation under field conditions is thought due to some factor other than bacterial differences.

Sugar beet seed testing, E. E. Down (*Michigan Sta. Quart. Bul., 5 (1923), No. 3, pp. 120, 121, fig. 1*).—American-grown seed averaged 9.22 tons of beets per acre with 13.41 per cent of sugar, while foreign seed made 8.58 tons with 13.94 per cent. Canadian seed excelled both in tonnage and sugar content.

Varieties of sugar cane, F. S. Earle (*Porto Rico Dept. Agr. and Labor Sta. Circ. 23 (1920), Spanish ed., pp. 3–12*).—Brief notes indicate the adaptation, resistance to mottling, and soil and cultural requirements of prominent sugar cane varieties.

Depreciation of cane caused by fire and by delays in shipping, F. A. López Domínguez (*Porto Rico Dept. Agr. and Labor Sta. Bul. 30 (1922), pp. 52, pl. 1, figs. 5*).—Experiments to determine the losses of weight and sucrose sustained by sugar cane when burned and left standing and by burned and unburned cane when cut and piled are described. See also an earlier note by Verret (E. S. R., 47, p. 231).

The canes subjected to fire while standing in the field lost about 2 per cent of their original weights, a wide variation being noted with the losses of individual canes. Stored burned cane lost about 2 per cent of its original weight per day. When the lighter stalks, both burned and normal, were stored they lost more in weight proportionally than did the heavier canes. The storage loss with burned cane exceeded that with unburned stalks by 0.64 per cent of the original weight of the cane.

Burned cane suffered inversion both when cut and when left standing, with the standing cane sustaining the greater sucrose losses. Unburned cane, cut and piled, lost through inversion up to 6.33 lbs. of sucrose per day per ton of cane during a storage period of 5 days, or 1.84 lbs. less than that endured by the burned cut cane and 3.19 lbs. less than by the burned standing cane.

[Sugar cane experiments in Hawaii], H. P. Agee (*Hawaii. Sugar Planters' Assoc., Rpt. Expt. Sta. Com., 1922, pp. 29–38*).—The further progress (E. S. R.,

47, p. 737) is reported of cultural and fertilizer tests, comparisons of varieties and seedlings, and improvement of sugar cane through bud selection.

Tobacco: Its culture and preparation, G. R. P. D'UTRA (*O Fumo: Sua Cultura e Preparação. Sao Paulo: Sec. Agr., Com. e Obras Pub. Estado São Paulo, Serv. Pub., 1921, pp. VII+137, figs. 43*).—Designed primarily for Sao Paulo, this handbook describes the tobacco plant and its varieties, qualities, and composition; details cultural and field methods involved in the production of the leaf; and summarizes curing and marketing practices.

Tobaccoland, C. A. WERNER (*New York: Tobacco Leaf Pub. Co., 1922, [rev. and enl. ed.], pp. 474, figs. 91*).—A revised and enlarged edition of the work noted (E. S. R., 33, p. 235).

Tobacco cultivation for nicotin, Nicotiana rustica, J. DU P. OOSTHUIZEN (*Union So. Africa Dept. Agr. Jour., 6 (1923), No. 2, pp. 166–175*).—Heavy applications of barnyard manure and close (12 in.) spacing in the row resulted in increased yields of cured leaf and stalk at the Rustenburg, South Africa, Experiment Station. The practice of topping, flue-curing, and green-sweating before air-curing seemed to produce increased nicotin contents, whereas reduction was observed with overripe plants, air-curing the whole plant instead of individual leaves, and drying in the sun. Distance of planting did not seem to alter the nicotin percentage. The nicotin content of *N. rustica* at different growth stages has been recorded by Juritz (E. S. R., 48, p. 231).

The Angeloni system for curing Kentucky and similar tobaccos, M. DONADONI (*Bol. Tec. [A. 1st. Sper. Coltiv. Tobacchi, Scafati], 19 (1922), No. 2. pp. 73–80*).—The consecutive operations in the Angeloni system include harvesting, yellowing, pressing, partially drying, stripping, further drying of the leaf, and successive mass fermentation. It is claimed that the curing process is so rapid that cigars may be made from the leaf 10 days after harvest. In the tests at Scafati, tobaccos so prepared were characterized by a very agreeable taste, a highly developed aroma, and a reduced nicotin content.

Natural crosses in Triticum durum and in T. vulgare, F. BOEUF (*Dir. Gén. Agr., Com., et Colon. [Tunis], Bul. 26 (1922), No. 110, pp. 447–462*).—Hybrids appearing in a uniform lot of Huguenot durum wheat from the Transvaal differed widely from their parent, and the F_2 segregated individuals with characteristics of varieties that were in rows adjacent to Huguenot the year before the crosses appeared. The F_1 of a variant found in a pure line of *T. vulgare* from Australia is also described.

An experiment in studying a cross between distinct species, Triticum durum × T. vulgare, G. MEISTER (*Zhur. Opytn. Agron. Iugo-Vostoka (Jour. Expt. Landw. Südost. Eur.-Russlands), 1 (1922), No. 1, pp. 49–72*).—Beardless forms of durum were obtained among other constant hybrids from crosses of *T. durum hordeiform* with a series of botanical varieties of *T. vulgare*, studied at the Saratov, Russia, Experiment Station. Analysis of the F_2 of such a cross gave indications that F_1 hybrids were subject to secondary pollination by plants of *T. durum*, which possibly accounts for the occurrence of *T. vulgare albidum* and other varieties of *T. vulgare* and of *T. durum* as admixtures in common wheats of the district.

Considerable difference was noted between the species as female and as male parents. When *T. durum* was used as the pollen parent fewer fertilized florets and a higher germination of seed were noted, and in the F_2 the durum characters were intensified and fewer dwarfs and more sterile plants were found. The hybrids of the durum type were much more fertile than those of *T. vulgare* and intermediate types. The cross with pure lines produced much fewer

sterile plants than when botanical forms were used. In addition to 19 varieties of *T. durum* and *T. vulgare*, and other forms, *T. dicoccum*, *T. compactum*, and plants approaching *T. turgidum* were obtained synthetically in this cross. This is thought to indicate the origin of *T. compactum* and *T. turgidum*. Many constant hybrids appearing in F_3 bred true for morphological characters, general habit of the spike, and grain.

The durum wheats, J. A. Clark and J. H. Martin (*U. S. Dept. Agr., Farmers' Bul. 1304 (1923), pp. II+16, figs. 5*).—The 12 varieties of durum wheat grown commercially in the United States are described, and their adaptations, cultural values, milling and baking qualities, and worth for the manufacture of semolina and macaroni are indicated. North Dakota, South Dakota, and Montana led in their production, which amounts to about 3,500,000 acres annually in the United States. Characteristics of the principal varieties in this class have been detailed in an earlier note (E. S. R., 44, p. 141).

Spring seeding pointers, C. R. Megee (*Michigan Sta. Quart. Bul., 5 (1923), No. 3, pp. 105–108, figs. 2*).—The adaptability of regional strains (E. S. R., 47, p. 829) is discussed, and mixtures for hay and pasture are suggested.

Varieties of self-sowing weeds and their distribution in the soil, I. N. Shevelev (*Trudy Ekaterinoslav. Oblastn. Selsk. Khoz. Opytn. Sta., No. 5 (1922), pp. 29, figs 3*).—Determination made in the Ekaterinoslav district in South Russia showed the most weeds to be present in the spring crop fields, running from 70,000,000 to 370,000,000 per acre. Most of the weeds were found not deeper than 2 in., and only about 6 per cent were seeded with the crop. Annual weeds made up about 79 per cent of the total and perennial about 17 per cent, with *Setaria viridis*, *S. glauca*, *Polygonum convolvulus*, *Avena fatua*, and *Plantago arenaria* predominating. The enormous spread of weeds in South Russia is considered due to the indiscriminate breaking of virgin soil and poor cultivation. Cleaning seed, cultivation after harvest, and fallowing are recommended as control measures.

Avena fatua and A. ludoviciana, I. N. Shevelev (*Trudy Ekaterinoslav. Oblastn. Selsk. Khoz. Oputn. Sta., No. 6 (1922), pp. 20, figs. 10*).—*A. fatua* is described as a serious weed pest in southern and southeastern Russia. It is much more prevalent in spring-seeded crops, particularly barley and wheat, than in winter-sown. About 88 per cent of the seed is found at depths less than 2 in. On one experimental plat *A. fatua* constituted 69 per cent of the plants and wheat only 10 per cent. A 5-year rotation recommended for its control includes millet, fallow, winter wheat or rye, corn or sunflowers with summer cultivation, and spring wheat or barley.

HORTICULTURE.

G. Harold Powell memorial (*Los Angeles: [Calif. Fruit Growers' Exch.], 1922, pp. [22], pl. 1*).—This memorial, prepared by friends and coworkers, contains information relating to the life and activities of this pomologist (E. S. R., 48, p. 798).

Artichoke culture in Sicily, G. Savastano (*Nuovi Ann. [Italy] Min. Agr., 8 (1922), No. 1, pp. 118–135, figs. 3*).—This paper contains general information relating to culture, varieties, and harvesting and marketing operations. An extensive bibliography is appended.

Practical fruit farming, R. G. Hatton and W. R. Elgar (*London: Roy. Agr. Soc. England, 1922, pp. 87, figs. 7*).—This pamphlet, containing information for the English fruit grower, is designed to present knowledge gained from recent research studies.

[Pomological studies at the New York State Experiment Station] (*New York State Sta. Rpt. 1922, pp. 44, 45*).—Without reporting data, brief comments are made upon the progress of various investigations.

No differences in commencement of fruiting or in character of growth were observed in 10-year-old apple trees, part propagated from buds and part from grafts. In comparing trees top-worked on Northern Spy with own-rooted trees of several standard varieties, the own-rooted trees were found to be the better, and no differences were noted in season of ripening, color, or quality of fruits.

A bud-selection study, in which buds from high- and low-yielding Rome Beauty trees were worked on Northern Spy-rooted cuttings set in the spring of 1912, failed to show any difference in favor of either group of parents. Careful observations upon the fruits of 84 Baldwin trees purchased in 1911 from 40 different locations in the United States showed no indication of variability, all the fruits being similar in size, color, season of maturity, and quality. In a test of six different plum stocks, Myrobalan proved to be the best species for almost all of the standard plum varieties of the State. Cherry stock studies indicated that Mahaleb is not only the best stock for sour but probably also for sweet cherries.

Studies on root development, B. T. P. Barker (*Univ. Bristol, Agr. and Hort. Research Sta. Ann. Rpt., 1921, pp. 9–15; also in Jour. Bath and West and South. Counties Soc., 5. scr., 16 (1921–22), pp. 257–264*).—Observations on the second year's development of the roots of apple trees worked on a clonal Paradise rootstock and subjected to various pruning treatments at the time of planting showed that, in general, the roots formed during 1920 (E. S. R., 46, p. 38) merely continued their growth in radial directions from the base of the tree. As in 1920, relatively little growth activity was observed in the original root system except in the collar region. The growing roots maintained a nearly horizontal course, confining themselves almost entirely to the upper foot of soil.

The effect of scion on stock was noted, e. g., the vigorous Allington Pippin produced trees with coarse roots, in sharp contrast to those of the weaker growing Stirling Castle. A lack of balance in the root systems was almost invariably accompanied by a lack of balance in the shoots, suggesting a close relationship between natural direction of shoot and root growth. Measurements given in tabular form of the circumference of trunk, number of shoots, and length of the second season's shoots show that root treatment at the time of planting had comparatively little effect on vegetative development. On the other hand, shoot pruning at the time of planting had, irrespective of root treatment, an appreciably stimulating influence on the new shoot growth of the second season, and to a lesser extent on the increase in trunk growth. While a tendency was noted for a greater number of buds to develop into new shoots in the case of trees treated normally at the time of planting, the average individual length of such shoots was materially less than in other treatments. Curiously enough, shoot growth on the rammed trees pruned when planted was relatively very much less than that of all other trees similarly pruned. The rammed trees, unpruned at planting, had the greatest average length of new shoot in the unpruned series.

For the purpose of studying the time and manner of root development, an ingenious device was improvised whereby the roots of trees suspended in casks were sprayed with nutrient solutions at regular intervals. The method proved much superior to the water cultures of the previous year and resulted in a healthy normal growth. There were recorded three well-defined phases of root development. The first, of brief duration, was marked by rapid concurrent root and shoot growth; the second, characterized by active shoot and relatively

inactive root growth, reached a maximum in midsummer; and the third was characterized by a slackening of shoot growth and gradual increase of root activity.

Pollination studies with Gravenstein and Åkerö apples, T. Lindfors (*K. Landtbr. Akad. Handl. och Tidskr., 61 (1922), No. 3, pp. 233–237, fig. 1*).—Pollination studies showed that the Gravenstein apple is practically self-sterile, and the Åkerö variety entirely so when the flowers are inclosed in sacks. Both varieties, however, produced satisfactory crops when pollinated with compatible sorts. Tabulated data are presented showing the pollen parents, the number of flowers pollinated, and the fruits set in the various operations.

Spraying and dusting experiments with apples in 1922, P. J. Parrott, F. C. Stewart, and H. Glasgow (*New York State Sta. Circ. 63 (1922), pp. 8*).—Prepared without discussion or conclusions, this circular presents detailed data, largely in tabular form, upon the results of investigations conducted in 1922 upon the comparative value of dusts and sprays for the control of various fungus and insect pests in apple orchards at North Rose, Hall, and Geneva.

Temperature, ventilation, and humidity as factors in the storage of the apple, L. M. Marble (*Canton, Pa.: Marble Lab., Inc., 1922, pp. 16, figs. 9*).—A preliminary report upon apple storage investigations at the Marble Laboratory, Inc. (E. S. R., 48, p. 236).

In comparing 32 and 35° F. as storage temperatures, it was found that apples kept much better at the lower degree. Experience showed that, with proper regulation, it is possible to maintain temperatures in bank cellars in the vicinity of 35° from the advent of the first severe cold weather until frost leaves the ground in the spring. Maturity of fruit at the time of storage is highly important. Northern Spy apples reaching the storage chambers in a perfectly ripe condition failed to keep satisfactorily, while home-grown Wealthy apples placed in 32° storage while relatively immature kept very well until April. Wealthy apples held for a time in common storage were practically gone by February.

Studies showed that temperature is the determining factor in respiration. At 35° respiration proceeded practically 50 per cent more rapidly than at 32°. Wounded or bruised apples respired more rapidly than sound specimens, thus explaining the tendency for such fruits to decay quickly. The percentage of carbon dioxid in the air in the intercellular spaces of apples held at 32° was low and that of oxygen high, while at 65° this relation was reversed. The amount of respiration at 65° was seven to eight times that occurring at 32°. Wilting, found due to improper humidity, was largely controlled by proper ventilation. Under comparable conditions varieties differed markedly in their tendency to wilt, the Baldwin and Esopus (Spitzenberg) being very susceptible and the Delicious and Rome very resistant. Fruits in barrels and those wrapped in oil papers did not wilt readily. Scald was particularly severe on barreled fruits, and was least on boxed fruits wrapped in oil papers and stored at 32° with humidity control.

Ventilation was found to be an extremely important factor in successful farm storage, especially in late fall and early winter, when the temperature of the storage chambers is usually rather high. In cold storage chambers ventilation after the initial cooling of the fruit was of chief importance only as a carrier of humidity, the factor which is responsible for the appearance of the apple in storage and for preserving its flavor and eating qualities to the end of the storage period.

Influence of the color of wall upon the ripening date of espalier-grown peaches, G. Rivière and G. Pichard (*Jour. Soc. Natl. Hort. France, 4. ser., 24 (1923), Feb., pp. 79–82*).—Self-recording thermometers placed 1 meter (3.28 ft.)

above the soil and 6 cm. (2.36 in.) in front of a wall, part of which was black and part white and upon which was trained a single variety of peach, indicated that the color of the wall had a very marked influence upon the temperature of the air near the wall and, incidentally, upon the rate of maturity of the fruits. On August 26 something over 66 per cent of fruit near the blackened surface was mature. At the same time only 14+ per cent near the whitened surface had ripened. The average temperatures for the six-month period March to September were 18.81° C. (65.86° F.) for the air in front of the white wall and 24.08° for that in front of the black wall. The differences were slight during March, April, and May and very marked during June, July, and August.

Further experiments in plum pollination, A. H. HENDRICKSON (*California Sta. Bul. 352 (1922), pp. 245–266, figs. 5*).—In continuation of work previously noted (E. S. R., 42, p. 41), the author discusses pollination studies with plum varieties at Vacaville and Newcastle.

Among Japanese plums, Apex, Duarte, El Dorado, Formosa, Gaviota, Prize, and Upright proved to be self-sterile. Formosa and Gaviota were intersterile, and Apex, El Dorado, Formosa, Gaviota, and Kelsey were so lacking in viable pollen as to be of doubtful value as pollinators for other Japanese varieties. Beauty, Burbank, Duarte, Santa Rosa, and Wickson, on the other hand, were effective pollinators for Japanese sorts. Beauty, Methley, and Santa Rosa were found self-fertile, at least to a limited degree.

In the Domestica group, Imperial, Tragedy, President, Quackenboss, Standard, and Washington failed to set fruit with their own pollen. Diamond and Pond behaved inconsistently, setting fruit one season and failing the next, and are, therefore, considered self-sterile. From a practical viewpoint, California Blue, Giant, and Yellow Egg were found self-fertile; and Grand Duke, contrary to results obtained at Davis, where it was found self-sterile under certain conditions, was able to set a small percentage of fruit with its own pollen. All Domestica plums blooming in midseason or later were apparently compatible with one another. Tragedy was able to pollinate Japanese varieties, but was not receptive to their pollen. The inclosure of the following pairs of varieties (1) Formosa and Wickson, (2) Beauty and Santa Rosa, and (3) Diamond and Grand Duke, in mosquito-net tents in which were placed hives of bees, resulted in much larger sets of fruit than were obtained in the open orchard.

Studies with the olive in Bari Province, Italy, C. CAMPBELL (*Bari Staz. Agr. Sper. Pub. 4 (1921), pp. 54, pl. 1, figs. 9; abs. in Internatl. Inst. Agr. [Rome], Internatl. Rev. Sci. and Pract. Agr., 13 (1922), No. 11, pp. 1336, 1337*).—The observation of nonblooming and sparsely fruiting individual olive trees led the author to study the flowers of these offtype trees. He found that in most cases the flowers contained imperfect pistils, varying in all gradations from rudimentary to quite normal condition. The proportion of abnormal flowers on a single tree was found to vary from branch to branch and from year to year. The grafting of scions from productive trees into unproductive trees caused the latter to be fruitful, and reciprocally scions from unproductive trees caused fruitful trees to become barren. Pruning, fertilizing, and spraying had no apparent relation to the abnormality of blossoms.

[Ringing experiments with black currants], B. T. P. BARKER (*Univ. Bristol, Agr. and Hort. Research Sta. Ann. Rpt., 1921, pp. 15–20; also in Jour. Bath and West and South. Counties Soc., 5. ser. 16 (1921–22), pp. 264–268*).—In connection with the above paper by the same author results of experiments in ringing black currants are reported in detail.

A notable development of adventitious roots below the wound was observed at the end of 10 days following the removal of a ⅛-in. ring of bark from the base

of 2-year-old black currants growing in sand cultures of different nutrient values. A few days later similar roots appeared above the wound. On the other hand, on control plants, the corresponding area of which was also wrapped in moist cotton, the adventitious roots did not appear until the end of three weeks, at which time the new roots of the ringed plants were in many instances over 1 in. in length. Replications of the experiment at approximately monthly intervals up to the end of the season showed that unringed control plants were nearly constant in the time required to produce roots. The treated plants, on the other hand, showed a marked periodicity in the time required for root formation, as follows: Quite rapid in the early part of the season, comparatively slow in May, June, and early July, with acceleration in the latter part of the growing period. This periodicity is compared with that of the water-culture apples, discussed in the above paper. With the exception of the early spring lot adventitious roots on the wounded plants were confined exclusively to the zone above the ring.

The addition of nutrient solutions to sand cultures promoted a more vigorous development of adventitious roots than occurred on unfertilized trees. Ringed plants held in darkness and similar plants from which all leaves were stripped developed only a few weak roots. When all current shoots as well as leaves were removed from ringed bushes, the root formation was slightly accelerated above that of the plants from which the leaves alone were removed.

In reviewing the results of the tests with currants, the author believes that the phenomena observed are closely correlated with food production and food movement within the plants, and believes that the tests should be of value in explaining some of the life processes in deciduous shrubs and trees.

Two important new types of citrus hybrids for the home garden—citrangequats and limequats, W. T. SWINGLE and T. R. ROBINSON (*Jour. Agr. Research* [*U. S.*], *23* (*1923*), *No. 4, pp. 229–238, pls. 5*).—As a result of previously reported crosses (E. S. R., 29, p. 839) between the kumquat (*Fortunella margarita*), and the citrange (*Poncirus trifoliata*×*Citrus sinensis*), and the lime (*C. aurantifolia*), new types of fruits have been evolved, which are believed by the authors to be capable of extending citrus culture a considerable distance northward. One of these hybrids, designated as the Thomasville citrangequat (kumquat×Willits citrange) and found hardy as far north as Georgia, is resistant to citrus canker and has potential value as a stock for the Satsuma orange and other citrus species. Cuttings have been successfully rooted in a propagating chamber, previously described by Goucher (E. S. R., 46, p. 235). The fruit itself is deemed of value in the preparation of acid beverages, marmalades, etc.

The Eustis limequat (lime×kumquat), also discussed in detail, is much hardier than the lime parent. The tree is more resistant to canker than the lime, and the fruit, closely resembling the lime, is deemed of use for the same purposes.

Brief comments are made upon other seedlings.

Preliminary report of the root systems of grape varieties, A. S. COLBY (*Amer. Soc. Hort. Sci. Proc., 19* (*1922*), *pp. 191–194*).—Marked varietal peculiarities were observed at the Illinois Experiment Station in a study of root growth of 6-year-old Concord, Delaware, Clinton, Norton, and Worden grapevines trained to the four arm Kniffen system. The soil, of a deep loamy nature, allowed for deep rooting, the maximum depth of the Concord being 5 ft. 9 in., of the Norton 6 ft. 1 in., and of the Delaware 7 ft. 8 in. The Concord and Delaware exhibited a tendency to form a two-story root system, part of the roots being in the upper layer of the soil and a part lying considerably deeper. The

Clinton and Norton, both extremely vigorous growers, were deep rooted and tended to gather food at a much greater depth. In conclusion the author points out that cultural and fertility practices may well be modified according to the actual rooting habits of varieties.

FORESTRY.

Report of the Pennsylvania Department of Forestry for the years 1920–1921 (*Penn. Dept. Forestry Rpt., 1920–1921, pp. 48, pls. 4*).—Information is presented concerning the various activities of the department, including forest protection, construction of roads and trails, accessions of land, planting and development of State forests, educational activities, and general utilization of funds. A forest map showing the subdivisions, forest trails, etc., accompanies the report.

The forest situation in Pennsylvania, J. S. Illick (*Penn. Dept. Forestry Bul. 30 (1923), pp. 14, pls. 2*).—This is a comprehensive statement of the forest resources of Pennsylvania, past, present, and potential. Attention is directed to the important rôle that forests play in the welfare of the State in supplying building material, fuel, and pure drinking water, and in reducing floods and providing ideal healthy recreation.

The program of the Swedish State Institute of Experimental Forestry for the period 1922–1926 (*Meddel. Statens Skogsförsöksanst., No. 19 (1922), pp. 66–78*).—This is an outline, with English summary, of forestry projects in progress or to be developed during the period 1922–1926.

Forest management in Indo-China, H. Guibier (*Bul. Écon. Indochine, n. ser., 25 (1922), No. 156, pp. 491–585, pls. 7, figs. 28*).—This general article relating to the development of forestry in this important French colony contains extended information concerning the location and the character of the forests.

Report on forestry in Uganda, R. S. Troup (*London: Crown Agents for Colonies, 1922, pp. 39, pl. 1*).—Based on a personal inspection trip, information is presented concerning the present condition of the forests, systems of management in operation, and forest department organization, with comprehensive suggestions for the improvement and development of the forest resources.

A guide to the identification of the more useful timbers of Nigeria, H. Stone and H. A. Cox (*London: Crown Agents for Colonies, 1922, pp. 111, pls. 3, figs. 13*).—Technical descriptive notes are presented upon a collection of woods supplied by the Government of Nigeria to the School of Forestry, Cambridge University. A key based upon anatomical variations is supplied.

Revolutionizing nursery practice, W. G. Hastings (*Jour. Forestry, 21 (1923), No. 2, pp. 180–182*).—The author has succeeded in producing at a much reduced cost plants equally as sturdy as transplants simply by pruning the roots in place with the aid of an underground draw knife so constructed as to cut away all the roots 6 in. below the surface. At the same time all weak specimens were removed by cutting off at the level of the ground.

Do thinnings actually increase growth per acre as compared to unthinned goods? T. T. Li (*Jour. Forestry, 21 (1923), No. 2, pp. 125–128*).—A critical study of data presented by Hawley (E. S. R., 47, p. 146) showed that the two causes which contribute to increased yield in thinned stands of white pine, (1) utilization of trees which would naturally die and decay and (2) actual stimulation of the remaining trees due to the removal of competition, are of practically equal value in this respect.

The deterioration of felled western yellow pine on insect control projects, J. S. Boyce (*U. S. Dept. Agr. Bul. 1140 (1923), pp. 8, fig. 1*).—Observations on the rate and nature of decay in 100 western yellow pine trees felled at different times from 1915 to 1921 in Klamath County, Oreg., in the effort to control bark beetles indicated that these fallen trees deteriorate with extreme rapidity. Determinations of the amount of decayed wood showed a tremendous increase in such material after the first growing season had passed. Trees cut in April, 1921, contained 13 per cent waste material in November of the same year, while on the same date trees cut in February, 1920, contained 63 per cent By the end of the seventh season there was little merchantable timber remaining, and this only in an occasional extra large tree.

The most important cause of loss in trees exposed for a single season was checking, sometimes extending deep into the heartwood, and caused in part by the heat occurring at the time of the burning of the bark and in part by exposure to the sun's rays. Sapwood rot accounted for most of the decay during and after the second season. Heart rot was not found until the third season of exposure.

Inasmuch as the study was conducted in a region deemed typical of a large part of the yellow pine belt, the author believes that his observations have a wide application and emphasize the fact that felled trees must be utilized by the beginning of the second season if any commercial return is expected.

Note on thingan (Hopea odorata Roxb.), A. Rodger ([*Indian*] *Forest Bul. 49 (1922), pp. 15, pls. 2*).—Notes are given concerning the distribution of the tree, the properties and uses of the timber, and available supplies of major and minor products. A veneer specimen accompanies the text.

Note on gurjun or kanyin, compiled by W. A. Robertson ([*Indian*] *Forest Bul. 50 (1922), pp. 7, pls. 2*).—This pamphlet on *Dipterocarpus* spp. is prepared in a similar manner to the above.

Camphor, Cinnamomum camphora, E. H. Wilson (*Jour. Arnold Arboretum, 1 (1920), No. 4, pp. 239–242*).—This paper contains information relative to the camphor-producing industry of Taiwan and adjacent countries. Although camphor is obtained in small quantities from southern Japan and from Fokien and Kwangtung Provinces of China, the real center of the industry is confined to Taiwan, where, apparently, the climatic conditions are very favorable to the secretion of the essential hydrocarbons which constitute camphor. The trees found scattered throughout the evergreen forest of the submontane region vary greatly in their camphor content, leading the author to suggest the possible value of selection studies. Despite the extensive planting program of the Japanese Government, the author believes that with the present rate of cutting of wild trees there will inevitably arise a period of scarcity.

Maple sirup making, P. A. Herbert (*Michigan Sta. Quart. Bul., 5 (1923), No. 3, pp. 139–141*).—Studies in maple sirup production indicated that with trees 14 to 20 in. in diameter the maximum profitable yields of sap were obtained from the use of two buckets per tree. On a basis of 100 per cent for one bucket, the yields for two, three, four, and five buckets were, respectively, 230, 210, 260, and 230 per cent.

Data based on 667 sugar maple trees showed a total production cost of $2.33 per gallon of sirup. Of this amount 30 per cent was for gathering sap, 23 for fuel, 20 for boiling sap, and the remainder made up by miscellaneous items.

General observations showed that large-crowned trees yield more sap than small-crowned trees. Tap holes $\frac{13}{32}$ in. in diameter and $1\frac{1}{4}$ to 2 in. deep gave satisfactory results. Buckets provided with covers were exceptionally satisfactory in producing a high-grade product.

DISEASES OF PLANTS.

Report of provincial plant pathologist, Vancouver, J. W. EASTHAM (*Brit. Columbia Dept. Agr. Ann. Rpt., 15 (1923), pp. Q 51–55, pl. 1*).—New or unusual diseases noted during the year included clubroot or finger and toe of crucifers (*Plasmodiophora brassicae*), blossom blight (*Sclerotinia fructigena*) of sour cherries skin spot (*Oospora pustulans*) of potato, and potato mosaic, the causation of which remains obscure.

Seasonal conditions during September and October favored disease conditions. Experiments attempting control of apple scab, the most important local apple crop disease in the Kootenays, are detailed briefly as showing excellent results for lime sulphur, with some foliage injury and possible fruit drop. Bordeaux dust appears promising, but larger scale testing is required. Sulphur dust permitted 87 per cent of scab in McIntosh apples despite four sprayings. Burgundy mixture reduced to a 1–1.5–40 strength and tested against Bordeaux mixture 3–4–40, showed 33 as contrasted with 9 infections per tree, though it caused less detriment to the appearance of the fruit.

A disfigurement developing in strawberries after picking appeared to be due to sunscald. Raspberry leaf rust (*Phragmidium imitans*) was negligible during the year.

Report of provincial plant pathologist, Vancouver, J. W. EASTHAM (*Brit. Columbia Dept. Agr. Ann. Rpt., 16 (1921), pp. U 64–67*).—Clover wilt disease (*Sclerotinia trifoliorum*) has appeared at two places in the Kootenay District. Tomato buckeye rot (*Phytophthora terrestria*) was found causing some greenhouse damage at Victoria. White pine blister rust (*Cronartium ribicola*) was noted at various points, being found almost exclusively on black currants, which suddenly showed heavy infection. The source is unknown. Control measures were initiated. Potato late blight was severe at points in the Delta and Lower Fraser Valley. Pear fire blight, though in the main controlled, still threatens from both the east and west the important fruit district of Creston. Any question regarding the alleged superiority of lime sulphur over Bordeaux mixture for anthracnose canker will probably require experimentation embracing all types of seasons. The percentages of apple scab (20 per cent) and of russet (2 per cent) found to occur in spite of dusting with 10 per cent dehydrated copper sulphate with 90 per cent hydrated lime are considered high as compared with the results obtained with careful spraying. Costs are detailed.

[Reports on plant diseases] (*Jour. Bath and West and Sourh. Counties Soc., 5. ser., 15 (1920–21), pp. 124–130*).—Observations and investigations during this period are very briefly noted below:

Apple tree canker. S. P. Wiltshire and G. T. Spinks (pp. 124, 125).—The observations previously noted (E. S. R., 45, p. 147) regarding infection by *Nectria ditissima* were extended considerably, and many new facts regarding this type of infection were obtained.

A bacterial infection of plum trees. Wiltshire (pp. 125–128).—A plum tree infection was found to be associated with a Cytospora and a bacterial organism, the significant relations, if any, between the two organisms not yet being apparent.

The bark canker disease of apples. Wiltshire (p. 128).—A disease of apple trees at Long Ashton, supposedly not reported hitherto for the country, is ascribed to *Myxosporium corticolum*. The seriousness locally of the disease lies in the fact that the main limbs of the trees are destroyed and sometimes the whole tree is killed.

A disease of Michaelmas daisies, Wiltshire (pp. 129, 130).—Brief preliminary notes refer to a disease of Michaelmas daisies, which came under notice during the previous summer, causing serious losses in one place and leading to a somewhat detailed investigation. The symptoms are outlined. The disease appears to be due to a fungus of the Fusarium type, which lives in the tissues of the stem and root.

[Plant diseases, 1921–22], B. T. P. Barker (*Jour. Bath and West and South. Counties Soc., 5. ser., 16 (1921–22), pp. 145–147, pl. 1*).—Inquiries, reports, and advices regarding plant diseases referred to a failure of raspberry buds in Somerset and Worcestershire provisionally ascribed to climatic factors, a Fusarium wilt of carnations, crown gall of loganberries, brown rot (*Sclerotinia fructigena*) of peaches, a leaf scorch of cherries, and an apical browning of apples.

[Plant diseases, northwest Africa], T. Steeg [*Gouvt. Gén. Algérie*], *Exposé Situation Gén. Algérie, 1921, pp. 512–514*).—The diseases reported include citrus canker in Tunis and Algeria; a triple infection of artichoke by *Bremia lactucae, Erysiphe taurica*, and *Ascochyta cynarae;* a new flax disease ascribed to *Phoma liniperda* n. sp.; attack of carob by *Ganoderma applanatura;* a serious disease of chick-pea, due to *Phyllosticta cicerella;* a wheat foot rot *(Gibellinia cerealis);* tomato diseases including *Phytophthora infestans* and a root rot (*Bacillus caulivorus*); and a grapevine disease (*Coniothyrium berlandieri*).

Report on the work of the botanical and mycological division [Ceylon], G. Bryce (*Ceylon Admin. Rpts., Sect. IV, Dept. Agr., 1920, pp. C 13–15*).—Rubber brown bast (cause still undetermined) was less prevalent during the year. Fomes root disease *(F. lignosus)* caused much loss. Brown root disease *(F. lamaoensis)* was of frequent occurrence. Stem disease *(Ustulina zonata)* was reported. Decays of renewing bark were less serious. Moldy rot (*Sphaeronema* sp.) cases yielded only *Fusarium* sp. and *Cephalosporium* sp. Leaf fall and pod disease *(Phytophthora faberi* and *P. meadii)* showed a decline associated with dry weather in September and October. Two cases were noted of *Fomes lucidus* fructifications occurring on Hevea apparently dead. This fungus causes root disease on coconut, *Poinciana regia*, and mango. A sooty fungus (*Meliola* sp.) does no serious damage. A leaf petiole disease is characterized by swelling followed by a superficial canker and leaf cast. Tea red rust (*Cephaleuros* sp.) again appeared.

Mosaic disease problems (*Michigan Sta. Quart. Bul., 5 (1923), No. 3, pp. 128–130*).—A brief account is given of investigations by Nelson (E. S. R., 48, p. 644), in which the occurrence of protozoa was reported in connection with mosaic diseases of beans, clover, and other plants.

Vegetable galls, H. Bastin (*Jour. Bath and West and South. Counties Soc., 5. ser., 15 (1920–21), pp. 30–56, pls. 4*).—This section of a series of reports deals with vegetable galls as regards character, origin, modes of causation, and causal agencies here listed to include insects, nematodes, and diseases due to fungi, bacteria, and slime molds.

Increase by selection of resistance to wheat smut, A. Morettini (*Staz. Sper. Agr. Ital., 53 (1920), No. 10–11, pp. 399–413*).—It is concluded from results of selection within the wheat variety Noe that even among the more susceptible wheat varieties it is possible to augment resistance to smut by systematic selection to a degree which is probably of practical importance.

A cytological study of infection of Baart and Kanred wheats by Puccinia graminis tritici, R. F. Allen (*Jour. Agr. Research [U. S.], 23 (1923), No. 3, pp. 131–152, pls. 6*).—A detailed account is given of investigations previously

reported in part (E. S. R., 45, p. 747). In the present paper special attention is given to the studies of Baart, a very susceptible variety, and Kanred, a resistant or immune variety.

It is found that the germination of the spores and the formation of the appressoria on the stomata take place in the same way in the susceptible and immune hosts. In Baart the fungus enters freely and grows rapidly, while in Kanred, under greenhouse conditions, only a few of the fungi pass through the stomata, the rest remaining outside until they shrivel and die. Kanred is said to possess three means of defense against this strain of stem rust, stomata which shut out the majority of the fungi, the heavy contact walls adjoining pathological cells, and a true immunity. The observations of the author are said to be in line with the theory that immunity is due to definite antagonistic chemical interactions between host and parasite.

Production and dispersal of conidia in the Philippine Sclerosporas of maize, W. H. WESTON, JR. (*Jour. Agr. Research [U. S.], 23 (1923), No. 4, pp. 239–278, pls. 10, figs. 2*).—In continuation of studies on the downy mildews occurring on maize in the Philippines (E. S. R., 43, p. 545; 44, p. 843), the author describes two downy mildews (*Sclerospora philippinensis* and *S. spontanea*), the conidial phases of which are injurious parasites of maize. His investigations bring out general information regarding the production and dispersal of conidia and the relation of these processes to the local and distant dissemination of the diseases. Conidiophores are said never to develop except from the stomata at night and when the surface is covered with dew or other moisture. Conidia are produced in vast numbers, and their production on an infected plant is not limited to a single night, but may be repeated over a period covering a considerable portion of the total life of the host. The dispersal of conidia takes place at night and is said to be accomplished chiefly by wind, although there is some dispersal by splashing of rain as well as through surface water, insects, and moist soil.

Various methods of dissemination are described in detail, and the possibility of each for local and distant distribution of the fungi is discussed.

Potato diseases, G. H. CUTLER and G. B. SANFORD (*Alberta Univ., Col. Agr. Field Husb. Circ. 7 (1921), pp. 23, figs. 14*).—The purpose of this circular is to describe briefly the potato diseases prevalent in Alberta and to outline a recognized means for the control of these diseases, which include scab (*Actinomyces scabies*), black scurf or Rhizoctonia (*R. solani*), Fusarium wilt (*F. oxysporum*), early blight (*Macrosporium solani*), late blight (*Phytophthora infestans*), tipburn and sunscald, blackleg (*Bacillus atrosepticus*), dry and wet storage rots (*F. tricothecioides* and *B. solanisaprus*), mosaic, leaf roll, spindling sprout and witches' broom, potato wart (*Chrysophlyctis endobiotica*), and internal tuber injuries.

Potato diseases in Nebraska, R. W. Goss (*Nebraska Sta. Bul. 186 (1923), pp. 3–32, figs. 12*).—In order to supply information needed by reason of the Nebraska potato grading law and the rules of the station relating to the inspection and certification of seed potatoes, the author has given information regarding the recognition and control of various potato diseases known to occur within the State.

After a discussion of the sections of the State devoted to potato growing and the general methods of disease control, descriptions are given of the various diseases grouped under the headings diseases due to parasitic organisms, unknown causes, and climatic and environmental conditions, about a dozen diseases in all being described. A tabulation is given of the diseases, symptoms, methods of transmission, and suggested means of control.

Relation of potato skin spot to powdery scab, M. Shapovalov (*Jour. Agr. Research [U. S.], 23 (1923), No. 4, pp. 285–294, pls. 4, fig. 1*).—The author's investigations are said to show that the primary cause of skin spot of potatoes is the fungus *Spongospora subterranea*, which is also the cause of powdery scab. His investigations showed that neither *Oospora pustulans* nor any other filamentous fungus is the primary cause of this disease, but that the skin spot pustules are essentially and primarily the closed or immature sori of powdery scab. Various fungi associated with the spots are said to be mainly secondary invaders developing during the storage period, and they do not represent a single species or genus, but may vary with the country, their prevalence being determined perhaps by climatic conditions and the flora of the soil.

Potato seed treatment, G. H. Cutler and G. B. Sanford (*Alberta Univ., Col. Agr. Field Husb. Circ. 10 (1921), pp. 4*).—This circular, prepared for the purpose of giving full details in the preparation and use of disinfecting solutions in the treatment of potato seed, deals with the use of corrosive sublimate and of formalin.

Length of the dormancy period of the sugar-beet nematode in Utah, G. Thorne (*U. S. Dept. Agr., Dept. Circ. 262 (1923), pp. 5*).—While engaged in a sugar-beet nematode survey in Utah an examination of soils from fields indicated that there was apparently a decrease in the number of nematode eggs remaining in the cysts corresponding to the number of years the land had not been planted with sugar beets. Studies were made of fields which had not been planted with beets for periods of 1 to 12 years, and as a result of the investigation it is believed that there is little or no possibility of eradicating the sugar-beet nematode from the soil by any method of crop rotation applicable to general farm practice. Rotations should be adopted which will build up the fertility of the soil as much as possible and at the same time allow the cleanest culture. One crop of sugar beets can be produced after such a rotation, but the nematodes will probably increase sufficiently in one year to damage a second crop very severely.

Mechanics of inoculation with sugar-cane mosaic by insect vectors, E. W. Brandes (*Jour. Agr. Research [U. S.], 23 (1923), No. 4, pp. 279–284, pls. 2*).—It is claimed that the only method for natural spread of sugar cane or grass mosaic is through the agency of insects acting as carriers or possibly as intermediate hosts. Studies are reported of a number of species of insects in which an attempt was made to determine how the insects inoculate plants with mosaic. In the case of *Aphis maidis* it is claimed that the beak is usually placed on the cuticle covering a stomatal guard cell at the point where the cuticle is thinnest and the setae thrust into it by pressure. During this process there is a copious secretion from the salivary glands. The setae were found to pass through the substomatal cavity and then through the mesophyll cells and finally in the phloem of the vascular bundle. During the whole process the copious secretion from the salivary glands of the insect pours into the practically uninjured and rapidly growing tissues of the leaf, and the author thinks that this secretion is unquestionably the medium by which the infective principle of mosaic is carried into the plant.

In the case of leaf hoppers (*Peregrinus maidis* and *Dracculacephala mollipes*), observations showed that the phloem is not specially sought by these insects during feeding. In the case of the latter species, while there is some evidence of salivary excretion, it is believed that it will be quite possible for this insect to penetrate to the vascular bundles by mechanical pressure alone instead of by the digesting or dissolving action of saliva.

Wildfire data and recommendations for control of the disease, G. H. CHAPMAN (*Tobacco, 75 (1923), No. 14, pp. 23, 25*).—Presenting data obtained from work testing the efficiency of tobacco-wildfire control measures recommended for 1922, the author offers detailed recommendations for this work during 1923, emphasizing the relative importance of measures to be applied to keep the seed bed and the seed before planting free from disease. These include sterilization by soaking for 15 minutes (only) in 1:1,000 mercuric chlorid solution; use of steam (but avoidance of wet conditions) on the seed bed; a 4–4–50 Bordeaux spray, or copper lime dust, to keep all new growth covered as it appears; killing out with 10 per cent formaldehyde any seedbed wildfire spots; and removal of any diseased plants that may appear in the field. Rotation is desirable where practicable.

[Fruit development and diseases, England], B. T. P. BARKER (*Jour. Bath and West and South. Counties Soc., 5. ser., 15 (1920–21), pp. 114–116*).—The fungicidal action of sulphur has been investigated by methods of which one, promising to prove satisfactory, consists in the oxidation of S to H_2SO_3 by the action of dry bromin and concentrated HNO_3 followed by estimation as barium sulphate. The determination of lethal percentages of volatilized S in the atmosphere can probably soon be effected. The experiments thus far suggest that S concentrations as low as 1:100,000 can be estimated with fair accuracy.

The pectic substances of fruits have been studied as regards the relationship between pectin and pectic acid. Quantitative data as to the variations in amounts of these substances at different stages in the ripening of the fruit have been secured.

Leaf scorch appears thus far to be a physiological disease, probably related to certain abnormal root conditions.

Factors governing fruit-bud production have been studied previously, and it has appeared that the ringing and notching of branches has produced definite effects both above and below the point of treatment. Further work seems to indicate that the Loeb hypothesis of a growth-inhibiting substance or toxin interprets the facts now available more satisfactorily than does the alternative hypothesis of actual deficiency of nutritive material.

Leaf scorch on fruit trees, B. T. P. BARKER, A. H. LEES, T. WALLACE, and S. P. WILTSHIRE (*Univ. Bristol, Agr. and Hort. Research Sta. Ann. Rpt., 1921, pp. 77–121; also in Jour. Bath and West and South. Counties Soc., 5. ser., 16 (1921–22), pp. 189–237*).—A systematic study of fruit tree leaf scorch led to the conclusion that the trouble is not due solely to a deficiency in the quantity of water supplied to the leaf as related to transpiration. As to the immediate cause of death the present position of knowledge does not justify any positive answer, and possibly it may differ in individual cases. On the practical side three factors stand out clearly, potash effect, the influence of grass, and rootstock action. These are discussed briefly.

Canker control trials, S. P. WILTSHIRE (*Univ. Bristol. Agr. and Hort. Research Sta. Ann. Rpt., 1921, pp. 70–73; also in Jour. Bath and West and South. Counties Soc., 5. ser., 16 (1921–22), pp. 269–272*).—The present note refers solely to the work done with more exact methods applied again to the varieties Kingston Black and Medaille d'Or apple seedlings during 1921, the report of earlier data having been noted previously (E. S. R., 48, p. 548).

Though the number of successful inoculations is increased by wet conditions of the soil, and though the growth of the fungus in the tissues is more rapid in the case of trees growing in a wet soil, the results obtained are recorded as not very significant.

Apple scab and its control, C. W. BENNETT (*Michigan Sta. Quart. Bul., 5 (1923), No. 3, pp. 130–134, figs. 2*).—A popular account is given of investigations

on the maturity and discharge of spores of the apple scab organism. It was found that the spores were ripe and ready to discharge in 1922 by April 17. At this time the apple buds had hardly begun to swell, and the evidence is considered to show the necessity of the prepink spray for the control of apple scab under Michigan conditions.

Spoilage of apples after harvest, D. F. Fisher (*British Columbia Fruit-Growers' Assoc. Ann. Rpt., 32 (1921), pp. 51–56*).—In an address at Victoria, B. C., in January, 1922, information was given chiefly regarding apple blue mold and apple scald.

Apple mold (*Penicillium expansum*), normally an unimportant wound parasite only, has been observed to attack partially matured apples on the trees at Wenatchee, Wash., this invasion following, in some cases, codling-moth injury.

Apple scald is an outgrowth of large volume fruit business, the result of crowding without provisions for effective aeration in loading fruit for shipment, being due directly to the action of gases produced in the respiration of the apples, and not to warming, as formerly supposed, due to the progress of the changes under warm conditions. Moisture short of the formation of drops is supposed to cause no scald injury. The formation of CO_2 (1 to 6 per cent) rather tended to prevent than to cause scald, and apples susceptible to scald were made immune by storing for a few days in an atmosphere of pure CO_2. The conclusion is reached that scald is largely due to abnormal respiratory conditions resulting from poor aeration, and that the conditions within the apple tissue which result in scald are of a cumulative nature. Apparently scald is not produced by high humidity nor by accumulations of CO_2, but probably by something that can be carried away by air currents or that possibly could be taken up by gas-absorbing substances. Absorbents tested included cornstarch, animal charcoal, excelsior, and sawdust. Apples were also wrapped in paper impregnated with paraffin, vaseline, cocoa butter, olive oil, and beeswax. The results show clearly that scald can be prevented by the absorption of the gases other than CO_2 given off by the apples themselves in storage. The hypothesis that the injurious gases are connected in some way with the odorous constituents of the apple was supported by experiments with two of these, amyl acetate and amyl formate.

Conditions of adequate aeration in storage are not usually easy to provide, and the benefits of ventilated storage as ordinarily found are only partial. While the air may circulate freely over the top of the stacks and through the aisles of the storage room, the fruit is usually so stacked that little or no aeration is provided within the piles, and especially inside the packages where the dead-air layers with their burden of injurious gases remain undisturbed. Consequently the treated wrap method, which provides each apple with its own preservative, appears to offer the most practicable method of meeting the problem.

Dusting and spraying for peach leaf curl, P. J. Parrott, F. C. Stewart, and H. Glasgow (*New York State Sta. Circ. 64 (1922), pp. 5–7*).—Experiments are reported in which the comparative value of lime-copper dust and lime-sulphur sprays was tested for the control of leaf curl of peach trees. In one orchard the sprayed trees were in better condition than those dusted, while in two others there was little difference in the percentage of healthy leaves per tree. Both treatments gave a much higher percentage of healthy leaves than the controls.

Red plant disease of strawberries, A. H. Lees (*Univ. Bristol, Agr. and Hort. Research Sta. Ann. Rpt., 1921, pp. 65, 66; also in Jour. Bath and West and South. Counties Soc., 5. ser., 16 (1921–22), pp. 183, 184*).—An account is

given of strawberry red plant regarding its appearance, distribution, symptoms, history, and possible causes, including lack of lime or other fertilizer, nematodes, or defective soil conditions.

The Michaelmas daisy disease, S. P. WILTSHIRE (*Univ. Bristol, Agr. and Hort. Research Sta. Ann. Rpt., 1921, pp. 74–76, pl. 1; also in Jour. Bath and West and South. Counties Soc., 5. ser., 16 (1921–22), pp. 272–274, pl. 1*).—The Michaelmas daisy disease, the causal fungus of which was isolated in 1920, has been the subject of further limited inquiry. A number of inoculations have been carried out, the details of which are given.

The results of these inoculation experiments show that the organism isolated is probably the causal organism. The fungus has not been named.

ECONOMIC ZOOLOGY—ENTOMOLOGY.

Habits of the common mole, Scalopus aquaticus machrinus (Rafin.), F. A. HANAWALT (*Ohio Jour. Sci., 22 (1922), No. 6, pp. 164–169*).—This is a report of observations of the bionomics of *S. aquaticus machrinus.*

The utility of birds (*Mass. Dept. Agr., Dept. Bul. 9 (1921), pp. 83, pls. 7, figs. 14*).—This is a review of the economic value of bird life.

Proceedings of the Acadian Entomological Society for 1921 (*Acadian Ent. Soc. Proc., No. 7 (1921), pp. 88, figs. 12*).—This report of the proceedings of the eighth annual meeting of this society, formerly known as the Nova Scotia Entomological Society (E. S. R., 46, p. 51), includes the following papers: Some Factors Influencing the Occurrence of Alate Forms in Certain Aphididae, by W. H. Brittain (pp. 7–29); Some Notes on the Natural Control of the Cecropia Moth, by J. D. Tothill (pp. 30–36); Notes on the Pine Needle Scale [*Chionapsis pinifolia* Fitch] and One of Its Enemies, by R. P. Gorham (pp. 37–41); The Use of White Arsenic as an Insecticide in Bordeaux Mixture on the Potato in New Brunswick, by G. P. Walker (pp. 42–44); An Estimate of the Damage Done in New Brunswick by the Spruce Budworm, by Tothill (pp. 45–48); Further Experiments in the Control of the Cabbage Maggot (*Chortophila brassicae* Bouché) in 1921, by Brittain (pp. 49–71); The Birch Leaf Skeletonizer [*Bucculatrix canadensisella*] Abundant in New Brunswick, by Gorham (p. 72), and Some Notes on the Female Reproductive Organs in the Hymenoptera, by A. B. Baird (pp. 73–88).

[Contributions on economic insects] (*Ztschr. Angew. Ent., 8 (1922), No. 2, pp. IV+229–490, pls. 4, figs. 17*).—The papers here presented (E. S. R., 47, p. 551) relating to insects of economic importance include the following: The Distribution of Anopheles in Bavaria, and Their Probable Importance in the Introduction of Malaria, by F. Eckstein (pp. 229–282); The Control of Anopheles in Rice Fields, by S. Konsuloff (pp. 283–294); Further Notes on the East Indian Rhinoceros Beetle (*Oryctes rhinoceros* L.), by K. Friederichs and E. Demandt (pp. 295–324); Contributions to the Knowledge of the Bionomics of Some Parasitic Hymenoptera, with Particular Consideration of Their Importance in the Biological Control of Insect Pests, which includes an index to 316 hosts and their parasites, by J. Fahringer (pp. 325–388); The Biology and Control of the Grape Root Weevil (*Otiorhynchus sulcatus* F.), by H. Thiem (pp. 389–402); A Binocular Attachment Devised for Observations on Standing Timber, by L. Rhumbler (pp. 403–412); The Parasites and Enemies of the Large Brown Weevil (*Hylobius abietis* L.), by G. Wülker (pp. 413–420); Tests of Blasting for the Control of White Grubs, by M. Dingler (pp. 421–426); Arsenicals, Viticulture, and Plant Protection, by F. Stellwaag (pp. 427–436); and The Grape Phylloxera Problem, by L. Lindinger (pp. 437–444).

Tree insects and their control, C. L. Pack (In *Trees as Good Citizens. Washington: Amer. Tree Assoc., 1922, pp. 183–222, pls. 4*).—This account of insect enemies of shade trees includes a tabular summary of information on the more important enemies of the various trees, and remedial measures therefor.

A new type of light trap for insects, C. B. Williams (*Egypt Min. Agr., Tech. and Sci. Serv. Bul. 28 (1923), pp. 2, pls. 2*).—The author describes and illustrates a portable light trap devised for use in the field.

Insecticides and fungicides; spraying and dusting equipment, O. G. Anderson and F. C. Roth (*New York: John Wiley & Sons, Inc.; London: Chapman & Hall, Ltd., 1923, pp. XVII+349, pl. 1, figs. 73*).—This manual is designed by the authors to offer instruction in the preparation of insecticides and fungicides, and in the construction, selection, testing, and operation of spraying and dusting equipment. The first part (pp. 1–174) consists of 78 laboratory exercises, presented under the headings of stomach poisons, contact poisons, fungicides, combination sprays, miscellaneous, fumigants, spraying equipment, and cost problems. Part 2 (pp. 175–334) consists of chapters on the control of insects, by J. J. Davis (pp. 177–182), control of plant diseases, by M. W. Gardner (pp. 183–188), spraying machinery (pp. 189–223), spraying accessories (pp. 224–273), dusting outfits (pp. 274–281), dusting as a means of controlling insect and fungus pests (pp. 282–300), miscellanies (pp. 301–316), and practical hints on running a gas engine (pp. 317–334). Miscellaneous data, including prices of materials, and manufacturers of spray materials and of spraying, dusting, and fumigating equipment are presented in an appendix.

Spray-spreading agents, T. Parker and A. W. Long (*Bur. Bio-Technol., Leeds, Bul. 8 (1923), pp. 252–258, pls. 2, figs. 6*).—The authors' studies are summarized as follows:

"Calcium caseinate greatly increases the wetting and penetrating power of a wash, and, in consequence, the active ingredients come into closer and better contact with the leaf and with the pest; the maximum effect (whether insecticidal or fungicidal) is thus obtained. A 0.2 per cent solution of calcium caseinate is approximately the lowest strength which will produce maximum wetting. Calcium caseinate appears to influence the deposition of particles from solution and suspension, causing them to be deposited in closer proximity to one another. It greatly retards the settling of arsenate of lead from suspension. It apparently increases the insecticidal and fungicidal efficiency of some washes by 100 per cent when these are compared with similar concentrations in ordinary water. It might be used with great advantage for assisting the penetration of washes in the control of woolly aphis. The results of the experiments suggest that winter washing with lime sulphur in conjunction with calcium caseinate might be successfully carried out at a dilution of 1–40 instead of at the present winter strength of 1–20."

Sodium arsenite as a killing agent in grasshopper baits, C. L. Corkins (*Colorado Sta. Bul. 280 (1923), pp. 3–15*).—The fact that white arsenic is extremely heavy and difficult to dry mix with bran and that it is only slightly soluble in cold water, making the wet mix faulty unless constant and vigorous agitation is kept up, led to the investigations here reported.

The experiments conducted indicate that sodium arsenite used in the strength of 1 pint to 100 lbs. of dry bran is fully as effective as either the Kansas bait or the standard formula, carrying 5 lbs. of 98 per cent crude white arsenic. Likewise, it seems to be practically as effective as the Kansas bait containing 4 lbs. of Paris green to 100 lbs. of dry bran. In the second experiment, 0.5 pint of sodium arsenite to 100 lbs. of dry bran gave good

results, yet there was a noticeable decrease in the killing power in comparison to the other formulas. As a killing agent in poison bran mash sodium arsenite has advantages over white arsenic in mixing, cost, handling, and in use in canned baits, and is deemed fully as efficient.

Spraying and dusting experiments for pear psylla in 1922, F. Z. HARTZELL (*New York State Sta. Circ. 65 (1922), pp. 8*).—Data on the control of the pear psylla durng 1922 in Niagara County and at Geneva are brought together in order that pear growers may benefit by the experiments.

Data on the effectiveness of dust and spray mixtures in 1921 and 1922, brought together in tabular form, indicate that the pear psylla can be controlled by spraying, provided two thorough applications are made when the insects are in the nymphal stages. The spraying gave very uniform results in the different orchards and for the several applications. The addition of a casein sticker appears to have given a slight increase in control by causing the liquid to spread better on the bark.

"It may be possible that psylla can be controlled by dusting, providing the trees are enveloped with a sufficient amount of an efficient material and that the insects are either in the late nymphal or adult stages. The operation must be so conducted that drifting dust does not pass through the trees before the full application is made. Dusting was extremely variable in efficiency, especially in the spring application. Dusting also allows more chances for failure and costs more per tree than does spraying."

The transmission of sugar cane mosaic by Aphis maidis under field conditions in Porto Rico, C. E. CHARDON and R. A. VEVE (*Phytopathology, 13 (1923), No. 1, pp. 24–29, fig. 1*).—The authors report that field observations and experiments conducted have led to the following conclusions:

"*A maidis* is found, with more or less abundance, in various grasses occurring in the sugar-cane fields of Porto Rico. After the weeding of the fields *A. maidis* passes to the sugar-cane plants, living in the central whorl of leaves for a period of time. During the short time that it stays on cane, *A. maidis* transmits the infective substance of the sugar-cane mosaic and carries the disease from diseased to healthy plants."

Aphididae of economic importance in Porto Rico, G. N. WOLCOTT (*Porto Rico Dept. Agr. and Labor Sta. Circ. 59 (1922), Spanish ed., pp. 3–11, figs. 9*).—This is a brief summary of information on several of the more important aphids occurring in Porto Rico, their natural enemies, and means of control.

The sugar cane mealybug and its control in Louisiana, E. R. BARBER (*Louisiana Stas. Bul. 185 (1923), pp. 16, figs. 9*).—A brief account of *Pseudococcus calceolariae* is followed by an extended discussion of control measures. It is pointed out that this mealybug is a minor cane pest in Louisiana where the Argentine ant is not present, but becomes a very injurious pest when protected by the ant. When the Argentine ant is controlled, the mealybug is automatically kept in check by its natural enemies. Experiments have shown that a weak poison sirup previously described (E. S. R., 43, p. 259) is the most practical method of controlling the ant, this poison sirup being placed in the cane fields in cans at the rate of 25 cans to the acre, at a cost of slightly more than $1. The poison sirup is best placed out as soon as possible after fall planting, though if so placed at any time before the middle of February the results will be satisfactory. Cans should be hung up and protected from the sun to arrest evaporation and to permit the ants to work in the shade.

The work is in cooperation with the U. S. D. A. Bureau of Entomology.

Lepidoptera attacking the leaves of tobacco in Porto Rico, G. N. WOLCOTT (*Porto Rico Dept. Agr. and Labor Sta. Circ. 53 (1922), Spanish ed., pp. 5–15, pl. 1, figs. 8*).—This is a brief account of several insects which attack the

tobacco leaf in Porto Rico, namely, *Phlegethontius sexta jamaicensis* Butl., *Pachyzancla periusalis* Wlk., *Phthorimaea operculella* Zel., *Plusia rogationis* Guen., etc.

Paradichlorobenzene for control of peach borer, P. J. Parrott, F. C. Stewart, and H. Glasgow (*New York State Circ. 64 (1922), pp. 2–4*).—The author reports, largely in tabular form, upon the results of control work with the peach borer in three orchards in which paradichlorobenzene was used. In two of the orchards, in which the trees were 8 and 9 years of age, all the borers in the treated trees were destroyed; in the third orchard, which was made up of trees varying from 2 to 5 years of age, only weak dosages were applied, and they were, consequently, less effective.

The peach twig-borer (Anarsia lineatella Zel.), W. P. Duruz (*California Sta. Bul. 355 (1923), pp. 419–464, figs. 18*).—This is a summary of information on the peach twig-moth, based upon a review of the literature and investigations conducted by the author in California. This insect is a serious pest in deciduous orchards in California, its injury being caused by the larvae boring into the buds, twigs, and fruit of the almond, apricot, nectarine, peach, plum, and prune. It passes the winter in the larval stage underneath the bark in small burrows constructed in the crotches of young branches. The larvae come out in the early spring and begin feeding on the buds and shoots.

"When the insects are full grown they crawl down the branches to the trunk, where they pupate in the curls of the rough bark. The adult moths emerge in early summer and begin egg laying on the twigs. About the first week in June a second generation of larvae begins to attack the twigs and particularly the fruit. Later in the summer a third generation emerges in some sections and causes serious injury to late ripening varieties of the fruits attacked. The fourth and last generation of larvae comes out late in September and begins at once to construct chambers and go into hibernation for the winter. These are also known as the first generation larvae of the following year. A parasitic larva, *Hyperteles lividus* (Ashm.), has been found in certain districts. In some seasons it destroys as high as 95 per cent of the hibernating larvae."

Spraying experiments conducted during 1921 and 1922, the details of which are presented in tabular form, show that this pest may be controlled by a number of materials and at different times. "Nicotin sulphate and arsenate of lead have, in these experiments, proved to be slightly better than lime sulphur in controlling this pest, but, in view of the fact that lime sulphur is an all-round fungicide and insecticide, it is advisable to use lime sulphur at the pink stage of the opening buds, with the addition of arsenate of lead in serious attacks. Bordeaux mixture and arsenate of lead, applied at the pink stage, is considered best on apricots in the coastal region because of the danger of lime sulphur injury to the fruit. The lime sulphur substitutes controlled the worms less perfectly than the commercial liquid lime sulphur. The oil sprays and the dry dusts can not be considered satisfactory remedies for this insect. Arsenate of lead applied as a summer spray has proved very efficacious on almonds, nectarines, and peaches. . . . Spraying must be supplemented by proper disposal of prunings of cull fruits, because they aid in carrying over the insect from one generation to another."

A list is given of 37 references to the literature.

The control of the grape-berry moth, R. H. Pettit (*Michigan Sta. Quart. Bul., 5 (1923), No. 3, pp. 141, 142*).—The author calls attention to the fact that the destruction of brush and shrub growth of all kinds in the close vicinity of vineyards aids greatly in the control of this pest.

Note on the aquatic caterpillar of Nymphula sp. (Microlepid.), H. C. Efflatoun (*Bul. Soc. Ent. Égypte, 14 (1921), pp. 29–31*).—These notes relate

to a species found among the leaves of *Najas marina* in the sweet-water canal at Suez. The caterpillars possess a complete adaptation to aquatic life through their branchial respiration.

Codling moth investigations of the State entomologist's office, 1915, 1916, and 1917, P. A. GLENN (*Ill. Nat. Hist. Survey Bul., 14 (1922), Art. 7, pp. IV+219–289, pls. 4, figs. 14*).—This is a detailed report of investigations, largely in tabular form, commenced in 1915 and conducted with a view to securing accurate data on the life history and seasonal history of the codling moth in Illinois and the relation of climatic conditions to the rate of development and the time of appearance of the various stages of the insect. The work was conducted at four stations, namely, Olney, Ozark, Plainview, and Springfield, which are well separated from each other.

The data at hand are said to be insufficient to enable a definite statement as to just how much allowance must be made in the time of appearance of the broods for difference of latitude, but, in general, the first pupae, moths, eggs, and young larvae appear 2 or 3 days earlier at Ozark and 2 or 3 days later at Springfield than at Olney, and the second and third broods of larvae appear about a week earlier at Ozark and a week later at Springfield than at Olney.

"The pupal period varies from 8 to 46 days, depending mainly upon the temperature. The period of the first brood is much longer than that of the second and third broods. The first brood period averages 30 days, the second 10.2 days, and the third 11.4 days. The life of the male adult in confinement varies from 3 to 24 days, the average being 10.5 days; the life of the female adult in confinement varies from 2 to 27 days, the average being 13.4 days. The female moth begins to lay eggs in from 1 to 5 days after emergence, the majority of the eggs being laid between the second and the fifth days, and oviposition is usually completed within 10 days. The egg period varies from 4 to 15 days, depending mainly upon the temperature. The average was 8.1 days for the 4,956 eggs under observation.

"The larval period varies from 18 to 47 days for transforming larvae and from 244 to 302 for hibernating larvae, the former averaging 26.4 days and the latter 264.8 days. The feeding period varies from 14 to 43 days for transforming larvae and from 16 to 54 for hibernating larvae, the average for the former being 24.7 and for the latter 29.3. The larval period in the cocoon varies for transforming larvae from 1 to 11 days and for hibernating larvae from 206 to 275 days, the average for transforming larvae being 4.2 and for hibernating larvae 206.1 days. The total life period varies from 41 to 70 days for individuals whose larvae transform, the average being 54.2, and from 287 to 332 days for individuals whose larvae hibernate, the average being 313 days. Larvae begin to go into hibernation about August 1, and during the month the percentage of maturing larvae which hibernate increases more or less rapidly, depending upon temperatures, until September 1, after which practically all larvae hibernate.

"Temperature is the predominating factor, so far as weather conditions are concerned, in determining the rate of development and the time of the appearance of the various stages. Development begins in the spring as soon as the temperature in the warmer parts of the day rises above 52° F., and the rate of development increases as the temperature rises, until the degree of the maximum rate of development is reached, which for the egg is about 88, for the larva 85, and for the pupa 87°. The pupa will not develop at temperatures below 52°, but the egg and larva will develop at temperatures above 50°. Temperatures above the degree of maximum rate of development retard development, and the retardation appears to be proportional to the number of degrees above the degree of the maximum rate, so that the rate of development at

1, 2, 3°, etc., above the degree of the maximum rate is the same as 1, 2, 3°, etc., below that degree.

"There is a fairly constant relation between the accumulation of effective day-degrees and the time of appearance of the different broods. For practical purposes, 50° may be used as the zero of development and 86° as the degree of maximum rate of development, and the effective day-degrees for any day may be determined by finding the average temperature above 50° and subtracting from it twice the average temperature above 86°. It requires an average of 163, 673, and 265 effective day-degrees to complete the development of the egg, larval, and pupal stages, respectively, and an average of 1,101 for the development of an individual through the three stages when 50 is taken as the zero of development and 88, 85, and 87 as the degrees of maximum rate of development for the egg, larva, and pupa, respectively. The number of effective day-degrees which accumulate from a certain stage in the development of one generation to the same stage in the development of the succeeding generation varies in round numbers from about 1,000 to 1,600, the average being about 1,195, when 50 is taken as the zero and 86 as the degree of maximum rate. The first larvae of the first, second, and third generations enter the fruit when the accumulations of effective day degrees have reached about 550, 1,550, and 2,550 day-degrees, respectively. The seasonal history of the codling moth for a normal year may be determined approximately in any locality by ascertaining the normal total accumulation of effective day-degrees for each day in the season in that locality."

Some notes on the Indian Calliphorinae, VI, VII, W. S. Patton (*Indian Jour. Med. Research, 9 (1922), No. 4, pp. 635–682, pls. 2, figs. 10*).—The sixth paper (E. S. R., 48, p. 254) on the subject deals with the identification of the Indian myiasis-producing flies and their larvae, and presents notes on methods of breeding them and studying their habits. The seventh paper, which concludes the series, deals with additional cases of myiasis caused by the larvae of *Chrysomyia bezziana* Vill., together with some notes on the Diptera which cause myiasis in man and animals.

The use of arsenic as a larvicide for anopheline larvae, M. A. Barber and T. B. Hayne (*Pub. Health Serv. U. S., Pub. Health Bul. 125 (1922), pp. 5–21*).—The authors record a confirmation of the work of Roubaud (E. S. R., 43, p. 853) to the extent that trioxymethylene was found to be very toxic to anopheline larvae both in laboratory and in field tests. This line of investigation was extended, however, in a search for some substance cheaper and more poisonous. Paris green was found to be highly toxic, the proportion of larvae surviving after a very small dose being always less than with any other poison tested, although it did not always cause a more rapid death than trioxymethylene. Lead arsenate and arsenic trioxid were both much inferior to Paris green as larvicides for anophelines, and powdered arsenopyrite seemed to be wholly inert. Calcium arsenate was decidedly less effective than Paris green, and its use in place of Paris green can not be recommended except in case of emergency. Paris green in antianopheline work should be diluted with a large proportion of inert dust, a dilution of one part of the poison to 100 parts of the inert dust appearing to be a favorable mixture. Road dust, preferably mixed with some fine clay, seems to be as effective as any; flowers of sulphur has not proved a suitable diluting dust. The quantity of Paris green to be used depends somewhat upon the character of the breeding place.

"Since the poison is relatively inexpensive, and the danger of poisoning the water of the breeding place small, quantities somewhat larger than those given in the protocol would seem to be advisable, possibly about 10 cc. (approximately

12 gm., 0.43 oz. avoirdupois, 0.6 cu. in., or 2 level teaspoonfuls) to 1,000 sq. ft. A slowly settling cloud of dust carried along by a light wind is apparently the best agent for the distribution of the dust, and the main thing is to start this cloud in the right place and direction. A single cloud may destroy larvae over a wide area and at a considerable distance from the operator.

"In sum, the possible advantages of arsenic dust used against anopheline larvae are its cheapness, portability, ease of distribution by means of the wind, and the possibility of using it over areas difficult of treatment by methods now in use. The chief disadvantage is that its use is limited to anopheline larvae—ova and pupae of all kinds, and culicine larvae are apparently unaffected. It is believed, however, that this method will have a place in antimalaria work, especially in places not easily drained and so covered by vegetation or other obstacles as to render them inaccessible to natural enemies of larvae or to other methods of treatment."

The rose chafer as a cause of death of chickens, G. H. LAMSON, JR. (*Connecticut Storrs Sta. Bul. 110 (1922), pp. 117–134, figs. 10*).—This is a brief summary of information on the life history and habits of the rose chafer, including its food plants and its poisonous effect upon chickens, an earlier account of which, by the author, has been previously noted (E. S. R., 34, p. 655).

Notes on Rhodobaenus 13-punctatus (Ill.), the cocklebur billbug (Col.), H. B. WEISS and R. B. LOTT (*Ent. News, 34 (1923), No. 4, pp. 103–106*).—An account is given of the biology of a billbug that appears to be more or less a general feeder within a wide range of plants.

Weevils of economic importance in Porto Rico, G. N. WOLCOTT (*Porto Rico Dept. Agr. and Labor Sta. Circ. 60 (1922), Spanish ed., pp. 5–20, figs. 20*).—This is a brief account of the important weevils occurring in Porto Rico.

The Fiji lemon weevil (Elytroteinus subtruncatus Frm.): Occurrence in some recent importations, D. MILLER (*New Zeal. Jour. Agr., 26 (1923), No. 1, pp. 34, 35, figs. 2*).—A brief account of *E. subtruncatus*, the larvae of which infested two consignments of lemons landed at Lyttelton in June from the Cook Islands.

The eulophid parasite of the chrysanthemum midge, A. B. GAHAN (*Ent. Soc. Wash. Proc., 25 (1923), No. 3, pp. 65, 66*).—Under the name *Tetrastichus diarthronomyiae* the author describes a new parasite reared from *Diarthronomyia hypogaea* Lw. at Baltimore, Md., in December, 1921.

FOODS—HUMAN NUTRITION.

Food for the family (*N. Y. Assoc. Improving Condition Poor, Nutrition Bur., Pub. 120, rev. (1922), pp. 31, figs. 2*).—The major portion of this book deals with the food problems of children of different ages, particularly in relation to the problems of the family as a whole.

Tapioca, a familiar food of unfamiliar origin, C. W. MEAD (*Nat. Hist., 22 (1922), No. 5, pp. 468–470, figs. 7*).—In this descriptive article information is given about tapioca making, and attention is called to an exhibit dealing with the subject in the American Museum of Natural History, New York, which shows how the Indians of North and South America make tapioca, which is a staple food of theirs.

Adlay, a new grain plant from the Orient, P. J. WESTER (*Jour. Heredity, 13 (1922), No. 5, pp. 221–227, figs. 6*).—This article is descriptive of adlay (E. S. R., 47, p. 163), its food characteristics being pointed out and its economic importance and similar matters briefly discussed.

The banana clock, A. H. SLOCUM (*Fruit Dispatch, 7 (1921), No. 6, pp. 188–194, fig. 1*).—Examinations of the air in which unripe bananas were stored

during transportation from the place of production to New York showed a regular fluctuation in the amount of carbon dioxid in the ventilating air, and that the "periodic rise and fall of the gas percentage seems to take place quite independently of any external cause." The nature of the respiration of bananas is discussed at some length.

Relation of home cooking to gas sales, A. J. PETERSON (*New York: Amer. Gas Assoc., 1922, pp. 15*).—Questions related to the use of gas for home cookery are discussed from the manufacturer's standpoint in this paper, presented at the 1922 convention of the American Gas Association.

Better country hotels, J. WILLY (*Hotel Mo., 31 (1923), No. 358, pp. 20–22*),—Suggestions regarding character of meals and their service are made, and other matters connected with problems of group feeding are discussed.

A comparison of the Du Bois and the Harris and Benedict normal standards for the estimation of the basal metabolic rate, W. M. BOOTHBY and I. SANDIFORD (*Jour. Biol. Chem., 54 (1922), No. 4, pp. 767–781, figs. 4*).—Mathematical data, consisting chiefly of computations of surface areas by various formulas, are presented which, in the opinion of the authors, are thought to indicate that the Du Bois normal standards, based on calories per square meter of body surface, are the best thus far available for predicting basal heat production. In making this claim it is admitted that the rate of heat production is probably not controlled by the area of the body surface nor by the cooling of the body, but is rather proportional to the active protoplasmic mass of the body for any given age and sex. The evidence that the protoplasmic mass is proportional to the surface area is, however, sufficiently convincing to make the determinations of the latter the most exact method of estimating active protoplasmic mass and consequently of predicting normal heat production.

Summary of the basal metabolism data on 8,614 subjects, with especial reference to the normal standards for the estimation of the basal metabolic rate, W. M. BOOTHBY and I. SANDIFORD (*Jour. Biol. Chem., 54 (1922), No. 4, pp. 783–803, figs. 9*).—The conclusions drawn in the above paper from mathematical considerations are confirmed by an analysis of basal metabolism data obtained in the authors' laboratory from March, 1917, to January, 1922, during which period over 25,000 basal metabolic rate determinations were made on 8,614 subjects. The data classified in 9 percentage ranges from 20 to below —20 are grouped in two tables, one covering 6,197 cases with thyroid disorders and the other 2,417 cases not due to thyroid disorders and including 127 normal subjects. The principal point to be noted in these tables is that 79 per cent of all the subjects other than those with disorders of the thyroid had basal metabolic rates within the restricted Du Bois normal limits of from 10 to —10 per cent, while 90 per cent had basal metabolic rates between 15 and —15 per cent.

Data are also presented in tables and charts on the surface area of the various subjects calculated by the Du Bois and the Harris and Benedict methods, and the basal metabolic rate as calculated by both standards. These data show, in confirmation of the conclusions of the previous paper, a close agreement between the surface areas as determined by both methods. With regard to the basal metabolism, the results are summarized as follows:

"The two points we wish especially to emphasize are, first, that a high percentage of persons has a basal metabolic rate within ±10 per cent and a very high percentage within ±15 per cent of the Du Bois standards for age and sex for each square meter of body surface, provided the subjects have no definite disease that is characterized by a pathologic alteration in the rate of heat pro-

duction, and, second, that a smaller percentage of these same subjects has basal metabolic rates within the same limits when the Harris and Benedict standards are used."

A seasonal tide of blood phosphate in infants, A. F. Hess and M. A. Lundagen (*Jour. Amer. Med. Assoc., 79 (1922), No. 27, pp. 2210–2212, figs. 3*).—Data are presented on monthly determinations of inorganic phosphorus in the blood of over 60 infants from 6 to 18 months of age for a period of 6 months from December, 1921, to June, 1922. The subjects were living under excellent hygienic conditions and were on a diet of certified raw milk or dried milk with orange juice and, in the case of the older children, cereals.

At the beginning of the study (December) the average amount of inorganic phosphorus was 3.92 mg. per cent, as compared with a level of 4.34 for the preceding July. The monthly determinations showed a steady decrease to the lowest value, 3.75, in March, followed by an increase more marked in each succeeding month until at June the level was only slightly below that of the preceding year. Although the phosphorus level was somewhat higher in the children on the certified than on the dried milk, the fluctuations were equally marked. With older children the variations were somewhat less marked, but again the level was lowest in March and highest in June. In adults there appeared to be no seasonal variations.

Evidence that this fluctuation is in some way connected with seasonal variation in the ultraviolet rays of the sun is shown in data reported on the seasonal variations in the sun's spectrum and also in meteorological data covering the period of the phosphorus tests, as well as in references to previous work showing the influence of ultraviolet radiation on the blood phosphate content.

The authors suggest in closing that "it is quite possible that 'the phosphate blood tide' is only one of many seasonal variations that take place in the body. This aspect of metabolism has not been the subject of investigation, but it would seem to be a promising field, and a systematic study of the blood from various points of view—chemical, immunologic, etc.—might well be undertaken on animals and on man and may reveal unknown seasonal peculiarities."

The action of certain fats on bone metabolism, G. Mouriquand and P. Michel (*Compt. Rend. Soc. Biol. [Paris], 86 (1922), No. 19, pp. 1170–1172*).—The authors have investigated the action of certain fats of animal or vegetable origin with relation to the antiscorbutic factor. In a preliminary series of experiments guinea pigs were fed barley, hay, and either butter, olive oil, or cod-liver oil. On this diet all the animals died of scurvy, thus showing that the fats contained no vitamin C. On substituting 10 cc. of lemon juice for the hay of the preliminary diet, the rest of the diet consisting of 30 gm. of barley, with 2.5 cc. of olive oil, 5 gm. of butter, or 2.5 cc. of cod-liver oil, the results obtained were as follows: Of 6 animals receiving olive oil 3 died on the thirty-eighth, fortieth, and sixty-second day, respectively, but with no scorbutic lesions, and 3 others survived to the one hundred and sixtieth day in good nutritive condition. Of 8 receiving butter 7 died in from 33 to 150 days but without scorbutic lesions, and 1 died on the fifty-fifth day from intense scurvy. Of the 10 animals receiving cod-liver oil all died between the twenty-ninth and one hundred and seventh day from typical scurvy.

It is concluded that cod-liver oil in some way counteracts the antiscorbutic effect of the lemon juice.

The relation of the vitamin function to calcium metabolism, K. Miyadera (*Biochem. Ztschr., 130 (1922), No. 1–3, pp. 199–208*).—This is the complete report of an investigation which has been noted briefly in a paper by Bickel (E. S. R., 47, p. 265).

Vitamins in ice cream, A. H. SMITH (*Jour. Amer. Med. Assoc., 79 (1922), No. 27, pp. 2221, 2222*).—Evidence is presented that the freezing of ice cream does not alter the original content of the ingredients of the ice cream in vitamins A and B, but that neither unfrozen nor frozen ice cream as prepared from pasteurized milk has appreciable amounts of vitamin C.

Studies of the nutritive value of the edible oils and fats.—I, The oil-bearing seeds and crude vegetable oils and fats, J. C. DRUMMOND and S. S. ZILVA (*Jour. Soc. Chem. Indus., 41 (1922), No. 8, pp. 125 T–127 T*).—In an effort to find an inexpensive source of vitamin A which might be made use of in margarin manufacture, the authors have determined the vitamin A content of various oil-bearing seeds and of the crude oil obtained from these seeds by extraction. The seeds tested included linseed, palm kernel, soy bean, cotton-seed, peanut, rape, fennel, kapok, cohune, Rangoon beans, cacao, candlenut, sesame, copra, and yellow and white corn. Some difficulty was encountered in administering the seeds and interpreting the results. Negative results were considered conclusive only when the seeds were known to be edible, or in cases in which the animals consumed the seed with relish and without ill effects but with no resumption of growth.

While very slight growth resulted in several cases, the only seed which appeared to have any appreciable value as a source of vitamin A was linseed. When fed in amounts of from 4 to 6 gm. daily in addition to the basal vitamin A-free ration, this seed brought about fairly good growth. These results are thought to confirm the view that the plant transfers only a small part of the vitamin A synthesized in the leaves to the reserve supply in the seeds even though they are rich in fat. Tests were also made of the oil obtained from some of the freshly crushed seeds by cold extraction with frequent changes of petroleum ether, the solvent being removed from the oil at low temperature. Very slight growth was obtained with 1 gm. and slow growth with 2 gm. of palm kernel, soy bean, peanut, and linseed oil; very slight growth with 2 gm. of yellow corn oil; and slow growth with the same amount of rape-seed oil, as compared with good growth on 0.2 gm. of average butter and 0.02 gm. of average cod liver oil. No explanation could be given of the poor results obtained with linseed oil as compared with the seed itself.

In discussing these results, attention is called to the relatively high value as a source of vitamin A of the highly pigmented crude palm oil obtained from the fruit pulp of the African oil palm, as compared with the colorless oil obtained from the seeds, the palm-kernel oil. This is thought to afford another illustration of the possible association of vitamin A with lipochrome pigments. An attempt to prepare from crude palm oil a palatable product rich in vitamin A which might be used in the manufacture of margarin has thus far been unsuccessful in that the unsaponifiable constituents in which the vitamin is concentrated possessed to a marked degree the characteristic odor and taste of the original oil.

Vitamin A content of lard obtained from hogs on a control ration, M. G. MALLON and M. CLARK (*Jour. Biol. Chem., 54 (1922), No. 4, pp. 763–766*).—To determine the effect of the feed of hogs on the vitamin A content of the lard, the fat from two hogs which had been on a feed rich in vitamin A was rendered in the laboratory under conditions which would preclude the destruction of vitamin A and used as the sole source of this vitamin in feeding experiments with rats.

The two hogs used in the experiment had been fed from July 2 to September 26, 1921, on shelled yellow corn and clover pasture and from that time to December 12, when they were killed, on yellow corn in dry lot. The experi-

mental diet for the rats consisted of lard (from both the leaves and back fat) 30, purified cornstarch 48, casein 18, and salt mixture 4 parts. The control diet was the same, with the exception that for 5 per cent of the lard butter fat was substituted. Each group consisted of four animals.

At the end of two months both groups had attained practically the same weight and seemed to be in the same healthy condition, but two days later all of the animals on the lard diet began to show inflammation of the eyes developing into ophthalmia, following which there was a decline in food intake and weight. Two of the animals died and the other two were given 0.5 gm. butter fat daily for three days, when the eyes began to clear up. The control animals remained well.

The final outcome of the experiment is thought to indicate that lard, even when made from the leaves and back fat of hogs on a feed rich in vitamin A, is not rich in this vitamin. The good condition of the experimental rats for two months is thought to be due to the previous storage of vitamin A in their bodies.

The effect of radiation with the mercury vapor quartz lamp on the growth of rats fed on a diet deficient in vitamin A, E. M. Hume (*Lancet [London], 1922, II, No. 26, pp. 1318–1321, figs. 3*).—This and the following paper contain the reports of investigations along the same general plan, one at the University Kinderklinik, Vienna, and the other at the Lister Institute, London, in an effort to correlate, if possible, the effect of vitamin A and of ultraviolet light radiation on the growth of rats. Since light and cod-liver oil have been found to be comparable in their effect on rickets, it was thought that if a similar relationship appeared to exist between the action of light and of vitamin A on growth the possibility of the identity of the growth-promoting and antirachitic vitamins would be strengthened.

In the present study three groups of rats received systematic radiation with the quartz mercury vapor lamp while on a diet deficient in vitamin A, the groups differing in that in the first, irradiation and deficient diet commenced at the same time; in the second, radiation was not begun until the animals showed definite eye symptoms from lack of the vitamin; and in the third, the radiation was begun after the animals had been for a shorter time on the diet deficient in vitamin A. From 3 to 5 rats were used in each group, with a corresponding number of controls on the same diet but receiving no radiation. Each group consisted of animals of from 50 to 60 gm. weight from different litters, each with a control from the same litter.

In the first group the controls ceased to grow in from 7 to 10 days, while the radiated animals grew at the normal rate for from 35 to 50 days, after which symptoms of vitamin A deficiency set in, xerophthalmia appearing earlier than in the control animals. In the second group attempts to renew growth and cure xerophthalmia by radiation failed completely and the animals succumbed even sooner than the controls. In the third group, consisting of animals which had been for 17 and 35 days, respectively, on the vitamin-deficient diet, the growth response appeared to be inversely proportional to the length of the period on the deficient diet.

The author concludes that light does not synthesize vitamin A in the body, but in some way acts as an economizer or activator of the vitamin already stored in the body. When this store is exhausted, the radiation no longer has any effect. The existing experimental evidence on the interplay between a vitamin factor and light for rickets is thought not to "exclude the possibility that the interplay in growth and rickets is the same, and the very existence of an interplay in both cases heightens the possibility that the two vitamin factors may be identical or nearly allied."

The effect of radiation with the mercury vapor quartz lamp on the growth of rats fed on a diet deficient in the fat-soluble growth-promoting factor, H. Goldblatt and K. M. Soames (*Lancet [London], 1922, II, No. 26, pp. 1321–1324, figs. 6*).—In this study along the same lines as the above, one group of rats was placed on the deficient diet at the age of 25 days and another at the age of 28 days and received radiation from then on. Another group consisted of the litter of an animal which had been on a diet lacking in vitamin A during the latter part of pregnancy and throughout lactation. The young were weaned at the age of 22 days and placed immediately on the dificient diet, with daily radiation. A final group received a vitamin A deficient diet until growth ceased and then received radiation beginning immediately, and 1, 2, and 3 weeks after growth had ceased.

The results in general paralleled those of the above research. During the first 5 or 6 weeks the radiated animals in the first and second groups grew at a normal rate and then ceased to grow, and finally showed in some cases signs of xerophthalmia. The controls during the same period grew less rapidly and developed signs of trouble at a smaller weight. Similar results were obtained with the third group, although the growth did not continue so long as in the other two groups. In the final series the rats whose growth had ceased for only a short period resumed growth for a brief period as the result of radiation, but those whose growth had ceased for 2 weeks or more were not affected by the radiation with the exception that in some cases decline in weight seemed to be accentuated and death hastened.

The general conclusions are the same as those of the above study, namely, that radiation with the mercury vapor quartz lamp can not act as a substitute for the fat-soluble growth-promoting factor, but in some way leads to an economy of the action of the vitamin already stored in the animal until this store is exhausted.

On blood platelets: Their behavior in vitamin A deficiency and after radiation, and their relation to bacterial infections, W. Cramer, A. H. Drew, and J. C. Mottram (*Roy. Soc. [London] Proc., Ser. B, 93 (1922), No. B655, pp. 449–467, figs. 5*).—The authors discuss the various symptoms exhibited by rats on diets deficient in vitamin A, and present evidence leading to the conclusion that the lesion most characteristic of vitamin A deficiency is a thrombopenia or deficiency in the number of blood platelets. It is stated that this thrombopenia may be found in rats kept on a vitamin A free diet before the animals show any obvious signs of ill health, and that the onset of the infective condition (xerophthalmia, etc.) depends on the level to which the platelets have fallen and not on the length of time the animals have been deprived of vitamin A or on the exposure to infection.

The infective conditions have been found not to develop until the blood platelet count has fallen from a normal value of from 700,000 to 900,000 to below 300,000 per cubic millimeter.

There is also shown to be a close relationship between the recovery from the blood lesions and the increase in blood platelets. On supplying vitamin A to animals on the deficient diet there is a prompt and rapid increase in the number of blood platelets. Evidence is also presented that in animals in a typical condition of vitamin A deficiency there is in the majority of cases no distinct reduction in the number of red cells nor any constant or characteristic changes in the leucocytes; that deficiency in vitamin B alone and malnutrition not due to vitamin deficiency do not diminish the number of blood platelets; and that exposure to radium results in marked lowering of the number of platelets, followed by spontaneous recovery with rapid rise in the blood platelets in a short time after the exposure to radium has been stopped.

These observations are thought to demonstrate that the blood platelets function in some way in the mechanism of resistance to bacterial infection, and that the various symptoms shown by animals on a diet deficient in vitamin A may be traced to the lowered resistance resulting from a fall in the blood platelets.

Quantitative aspects of the rôle of vitamin B in nutrition, T. B. OSBORNE and L. B. MENDEL (*Jour. Biol. Chem., 54 (1922), No. 4, pp. 739–752, figs. 4*).—To determine the actual daily requirement of vitamin B for rats at various stages of their growth through the period of adolescence, a series of feeding trials under carefully controlled conditions was continued for over a year according to the following plan:

A food mixture of casein 18, starch 54, lard 15, butter fat 9, and salt mixture 4 per cent was supplied ad libitum to all the experimental animals. The vitamin B product, which was fed separately, consisted of tablets prepared from a single lot of dried brewery yeast. The feeding experiments were begun with animals of different ages weighing 40, 70, 150, and 240 gm., no less than 5 rats, usually males, being employed in each test. For corresponding series of animals for the different ages and weights as noted above, the dosage of yeast was varied to include 25, 50, 100, and 200 mg. daily. The same dosage was continued for one year unless serious decline in weight took place, when it was increased in a number of cases. "In this way it became possible to ascertain not only what doses of vitamin-bearing supplement were required at different ages until adult size was reached, but also whether a more or less prolonged preliminary period of less 'artificial' feeding on food mixtures which have been demonstrated to be adequate in every respect for the nutritive well-being of the rat would alter the subsequent vitamin requirement." The results obtained are reported in graphic form, showing the changes in body weight of animals in the successive groups on the same yeast dosage.

In the four groups receiving 200 mg. of dried yeast daily the animals, with few exceptions, reached the average adult size within the average time. With 100 mg. the results were less satisfactory, particularly after the animals reached a weight of 200 gm. With the smaller doses, 50 and 25 mg., the rate of growth was more or less retarded from the very beginning of the experiment, and in the case of the larger animals 25 mg. failed to secure even maintenance of body weight.

On recalculating the various dosages to the amount in milligrams per 100 gm. body weight, the daily requirement appeared to have a quantitative relationship to the mass of active tissue and to approximate from 50 to 60 mg. of the dried yeast daily. The observation that a number of the larger animals appeared to require a smaller amount of the vitamin per unit of body weight is explained on the ground that these animals were comparatively rich in fat and the actual amount of active tissue was smaller than the weights would indicate.

As a further illustration of the dependence of the rate of growth upon the vitamin dosage, the growth curves are shown of 6 rats from the same litter, each of which was put when it reached a weight of 100 gm. on the standard diet, but with varying amounts of yeast. With decreasing amounts of yeast the growth was about the same for a short time, after which there was a decrease in the rate of growth, becoming more marked with the smaller amounts of yeast. The correlation between the size of the animal and its requirement of vitamin B is further shown by the growth curves of animals fed varying dosages of the more concentrated vitamin extract of Osborne and Wakeman. With 40 mg. of this concentrate growth usually stopped when the

rats reached a size of somewhat less than 200 gm., but with slight additions growth was promptly resumed.

Vitamin B in the edible tissues of the ox, sheep, and hog.—I, Vitamin B in the voluntary muscle. II, Vitamin B in the edible viscera, R. HOAGLAND (*U. S. Dept. Agr. Bul. 1138 (1923), pp. 48, figs. 45*).—This publication reports the results of an extensive study of the vitamin B (antineuritic) content of the voluntary muscles and edible organs of the ox, sheep, and hog.

Healthy pigeons weighing between 300 and 400 gm. at the beginning of the experiment were forcibly fed a ration of autoclaved polished rice and the material being investigated in amounts equivalent to 5 per cent of the initial weight of the pigeon. The data reported include the change in weight, survival period, and condition at the end of the experimental period. "The term 'survival period' as used in this paper denotes the period between the start of the experiment and the development of positive symptoms of polyneuritis, death due apparently to polyneuritis, or the close of the test."

Of 22 birds receiving from 15 to 25 per cent of their ration in dried ox muscle of various cuts, all lost in weight and all but 3 developed polyneuritis in from 12 to 37 days. Of 4 receiving 15 per cent of ox tongue 3, and of 4 receiving 25 per cent ox tongue all developed polyneuritis in from 18 to 49 days. Of 4 birds fed 15 per cent calf muscle, all developed polyneuritis in from 19 to 47 days, and of 8 fed 25 per cent of this muscle, 6 developed polyneuritis in from 18 to 32 days, and 1 severe keratomalacia.

In similar studies with sheep or lamb muscle, out of 22 birds receiving from 15 to 25 per cent of the muscle there were in one group 3 which are reported to have been in normal condition after having been fed 25 per cent of muscle for 32 days and to have gained in weight during this period. Two others in two different groups did not develop polyneuritis. All of the others developed polyneuritis in from 15 to 35 days.

The results obtained with hog muscle were in striking contrast to those obtained with beef and sheep muscle. Of 22 pigeons fed dried fresh pork tenderloin or fresh ham, none developed polyneuritis and, with two exceptions, all gained in weight during the experimental period of from 49 to 55 days. Equally favorable results from the standpoint of polyneuritis, but slightly less favorable from the standpoint of weight, were obtained with 15 pigeons fed dried smoked ham or tongue in 15 and 25 per cent amounts. In all of these experiments the meat was fed raw, but in a series of control experiments in which pork tenderloin and ham were cooked as for serving before being dried and fed, no cases of polyneuritis developed and the pigeons gained in weight.

These results would seem to indicate that beef and sheep muscle are of little value as a source of antineuritic vitamin, but that hog muscle is much richer in this vitamin. As a possible explanation of this difference, the author suggests that it may be due to a difference in the antineuritic properties of the rations fed to the different animals or that possibly "the hog may have the peculiar function of storing up a larger proportion of the vitamin in its tissues than do the other animals named."

The second part of the investigation consisted of a similar examination of the edible viscera of the ox, sheep, and hog. In experiments conducted with ox liver, 4 pigeons fed 5 per cent of the dried liver developed polyneuritis in from 39 to 45 days, 3 out of 4 fed 15 per cent developed polyneuritis in from 37 to 45 days, and 1 of 4 fed 30 per cent developed polyneuritis after 93 days. The rest of the pigeons in this group gained in weight and were in good condition at the end of 105 days. Calves' liver in corresponding amounts was apparently of lower antineuritic value, as even 30 per cent proved insufficient to protect against polyneuritis. Of 5 pigeons fed 15 per cent of lamb liver, all developed

polyneuritis in from 16 to 24 days, while of 5 fed 25 per cent, only 1 case of polyneuritis developed. Hog liver proved a better source of antineuritic vitamin, as only 1 of 4 fed 15 per cent and none of those receiving 25 per cent developed polyneuritis. The results obtained with other organs may be judged by the author's summary of the relative values of the different organs and blood from the ox, hog, and sheep, respectively.

"The ox.—The heart had the highest value, followed closely by the kidney and the liver. The other products had considerably lower values in the following order: Spleen, lungs, brain, calf thymus, calf pancreas, tripe, serum, ox blood, calf blood, and ox-blood corpuscles.

"The hog.—The heart and liver had practically the same value and the kidney a slightly lower value. The spleen, pancreas, chitterlings, and stomach, in order, had much lower values.

"The sheep.—The heart had the highest value, followed closely by the liver. The brain and lungs, in order, had much lower values."

Further investigations on the vitamin problem, F. Groebbels (*Klin. Wchnschr., 1 (1922), No. 43, pp. 2130, 2131, figs. 3*).—The investigation previously noted (E. S. R., 48, p. 261) has been extended to a further study along the same lines involving the use of 22 white mice. The first point investigated was the effect of feeding oats on the oxygen consumption and body weight of mice in the so-called first state of avitaminosis which, according to the author, is characterized by gain in body weight and in oxygen consumption.

On the alternate feeding of polished rice and oats for periods of 2 days each, the curves for both these values (weight and oxygen consumption) showed in the polished rice period a gain and in the oats period a loss followed by a gain. This experiment was followed by a similar one in which 1 mouse was fed 9 days and the other 13 days on polished rice and then fed oats. The curves for growth and oxygen consumption showed, after the initial gain on the polished rice diet, a progressive loss, followed by prompt rise in the curve on the administration of the oats. This is thought to give further proof that the second stage of avitaminosis resembles inanition.

The final point investigated was the effect of hunger on mice in the first state of avitaminosis. Ten animals of various ages were fed a normal diet for some time, then polished rice for 3 days. Following this no food was given for from 20 to 24 hours, and then polished rice. For comparison the effect was also studied with 4 animals of starvation following oat feeding. While the results as reported were quite variable, the average of the entire series showed greater sensitivity to starvation of the animals on the deficient diet than those on the normal.

Remarks concerning some experiences in avitaminosis, E. Abel (*Compt. Rend. Soc. Biol. [Paris], 87 (1922), No. 37, pp. 1213–1215*).—A few experiments with newly hatched chickens and ducks on rations sterilized at 125° C. for one hour are reported. In chickens the conditions induced by the sterilized diet were similar in all respects to the polyneuritis induced in pigeons by an exclusive diet of decorticated grains. In ducks, however, the symptoms appeared to be more like scurvy, intense congestion of the bone marrow of the femur and tibia, with hemorrhages along the tibial periosteum and in some cases spontaneous fracture of the femur. In all cases there was less resistance to the harmful effects of the sterilized food than in older birds, and, in the case of the ducks, those removed prematurely from the shell succumbed earlier than those hatched in a normal manner.

Discussion on the etiology of rickets (*Brit. Med. Jour., No. 3227 (1922), pp. 846–858*).—This symposium on rickets, held at the annual meeting of the

British Medical Association, Glasgow, in July, 1922, consists of general papers by L. Findlay and E. Mellanby and discussion by R. Hutchison, V. Korenchevsky, D. Galbraith, J. S. Wallace, H. S. Hutchison, J. B. Orr, and W. Elliot.

The acid base ratio of the diet in rickets production, T. F. Zucker, W. C. Johnson, and M. Barnett (*Soc. Expt. Biol. and Med. Proc., 20 (1922), No. 1, pp. 20–22*).—The authors report that they have succeeded in preventing rickets in rats on a diet which ordinarily induces rickets (flour, casein, calcium lactate, sodium chlorid, and traces of ferric citrate) by simply adding 2 per cent of ammonium chlorid to the diet By adding 2 per cent of sodium carbonate to a rickets-preventing diet of flour, egg albumin, and potassium phosphate marked rickets was induced. The essential changes in the two diets caused by the addition of ammonium chlorid and sodium carbonate, respectively, were in the acid-base ratio of the food, the balance being shifted to the acid side in the first case and to the strongly basic in the second.

The significance of these experiments is considered to be in the suggestion that rickets may be induced by a reduction in the H-ion concentration of the digestive tract, with consequent defective absorption of calcium and phosphorus.

The rickets-producing effect of dried thyroid, E. Mellanby (*Jour. Physiol., 57 (1922), No. 1–2, pp. II, III*).—This is a brief report of feeding experiments with puppies, the results of which indicate that on diets which are on the border-line with respect to the causation of rickets, the animals receiving small doses of dried thyroid will develop severe rickets, while those not receiving thyroid remain normal or show only slight signs of rickets.

A study of light waves in relation to their protective action in rickets, A. F. Hess, A. M. Pappenheimer, and M. Weinstock (*Soc. Expt. Biol. and Med. Proc., 20 (1922), No. 1, pp. 14–16*).—This has been essentially noted from another source (E. S. R., 48, p. 365). Of the different kinds of glass used, it is noted that window glass obstructs the protective rays, while pyrex glass interferes but slightly with them. It is concluded that rays as long as 334 $\mu\mu$ have little or no protective action in rickets, and that the effective rays begin in the neighborhood of 310 $\mu\mu$.

Report of work on energy expenditure for sewing and some other household tasks, C. F. Langworthy (*Jour. Home Econ., 14 (1922), No. 12, pp. 621–625*).—The data reported have been previously noted (E. S. R., 44, p. 66).

ANIMAL PRODUCTION.

The sugars and albuminoids of oat straw, S. H. Collins and B. Thomas (*Jour. Agr. Sci. [England], 12 (1922), No. 3, pp. 280–286; also in Jour. Min. Agr. [London], 29 (1923), No. 11, pp. 993–997*).—An investigation of the cause of the difference in feeding value of oat straw grown in Scotland and England was carried on at Armstrong College, England. The analyses of samples of straw grown with different fertilizers and in different sections showed that the sugar content varied from 0.33 to 9.74 per cent and the protein content from 1.12 to 8.05 per cent. The plant food in the soil seemed to be largely responsible for the variations in protein, whereas the sugar content seemed to depend on the weather at harvest time. Straw harvested in wet seasons was usually low in sugar.

Bran, shorts, middlings, and feed flour.—An investigation toward revised standards, F. T. Shutt and S. N. Hamilton (*Canada Dept. Agr. Bul. 2, n. ser. (1922), pp. 24*).—In making an investigation of the present Canadian standards for wheat feeds, 60 samples of bran, 84 of shorts, 20 of feed flours,

and 30 samples of screenings were analyzed for moisture, protein, fat, carbohydrates, fiber, and ash. The following revised standards were suggested for bran: Protein 15 per cent, fat 3.5, and fiber 11.5 per cent; for pure shorts, protein 16 per cent, fat 5, and fiber 8 per cent; for flour middlings, protein 16.5 per cent, fat 3.5, and fiber 4.5 per cent; and for feed flours, protein 18 per cent and fat and fiber 3.5 per cent each. Screenings appeared to contain valuable nutrients, but they were extremely variable in composition.

Feedstuff analyses, H. B. McDonnell (*Md. Univ. Quart., No. 92 (1921), pp. 24*).—This is the report of the analyses of feeding stuffs inspected during the year ended May, 1921.

Commercial feeds, 1921, J. O. Halverson and L. M. Nixon (*N. C. Dept. Agr. Bul., Aug., 1922, pp. 47*).—The analyses of officially inspected feeds collected during 1921 are reported, and the accepted definitions of feeding stuffs are given.

Report of the bureau of feeds and fertilizers on feedstuffs, B. W. Sebring (*Ohio Dept. Agr., Bur. Feeds and Fert. Spring Rpt. 1921, pp. 7–100*).—This consists of the guaranteed and found analyses of feedstuffs analyzed in Ohio during the spring of 1921. Definitions of feeding stuffs and an article on Manufactured Feeds, by C. W. Gay, are included.

A contribution to the question, Are acquired characters inherited? Börngen (*Jahrb. Wiss. u. Prakt. Tierzucht, 15 (1922), pp. 125–162*).—A review is given of the earlier theories of inheritance of acquired characters with special reference to the theories advanced by Lamarck, Weismann, and Darwin, followed by a discussion of the more recent results of P. Kammerer with salamanders.

The inheritance of color and pattern in rabbits, E. Pap (*Ztschr. Induktive Abstam. u. Vererbungslehre, 26 (1921), No. 3–4, pp. 185–270, figs. 20*).—Based on the results of breeding experiments at the Institute of Hereditary Research in Potsdam, the color and pattern in rabbits is attributed to the action of 18 factors. Pigment is due to 2 factors, A and X, whereas 4 factors determine dark color, B, C, D, and E. G determines wild color, O is a factor for tan and is linked with G. Y_1, Y_2, etc., determine the limits of yellow spotting. Q is linked with B and is a check factor on the action of G and also of O. N is a factor for the Russian pattern and is linked with A. Dominant P or recessive F determine silver color. M determines the Japanese pattern, and K English spotting. S_1, S_2, S_3, and S_4 are factors which determine the limits of the Dutch pattern. L is a uniform color factor epistatic to S_1, etc., and V is a factor for hair length. The action of these factors is dependent upon the presence or absence of certain other factors in most cases. The experiments in which crosses of animals representing different genotypes are reported and the number of phenotypes which appeared in each case are tabulated.

A comprehensive review of the work of other investigators dealing with the method of inheritance of color and markings in rabbits is given, and more recent work which has been done by Castle and Punnet is reported in detail.

Osteological differences between the Swiss Field hares and Alpine hares, W. Hauser (*Ztschr. Induktive Abstam. u. Vererbungslehre, 26 (1921), No. 1, pp. 32–108, figs. 33*).—In a study carried on at the University of Zurich, the skeletons of 108 Alpine hares (*Lepus medius varronis*) and 108 Field hares (*L. europaeus*) were compared. Measurements of the different parts of the skeleton were made, and the relationship between the lengths of certain bones in the one species was compared with the corresponding measurements in the other species.

In general the Alpine hare showed greater width of the cranial cavity, which also occurred in the younger animals. As compared with the entire skull, the face was correspondingly larger in the Field hare, but the difference was less in the young. The lower jaw of the Field hare was longer, more slender, and less angular than that of the Alpine hare, and the upper incisors on cross section were rectangular in shape, whereas those of the Alpine hare were square and the lower incisors were correspondingly more slender.

In measurements of the bones of the legs it was found that the phalanges were longer, and the hind-leg bones as compared with the foreleg bones were also proportionately longer in the Alpine hare than in the Field hare. In the Alpine hare the radius length varied from 67 to 72 per cent of the tibia length, whereas the relationship in the Field hare was 73 to 78 per cent. Since there was no overlapping between these measurements, it is stated that this relationship, together with the shape of the upper incisor teeth on cross section, may be used to differentiate the species. The number of coccygeal and sacral vertebrae in the Alpine hare varied from 16 to 17, with 3 individuals having 18, whereas in the Field hare the number varied from 18 to 19, with 1 animal having 20.

This investigation was carried on in preparation for later experiments in crossing the two species.

National animal life, A. Bartolucci (*Italia Agr., 59 (1922), No. 7, pp. 217–226, figs. 3*).—This is a discussion of the domestic animals in Italy, with special reference to the best breeds of live stock for improving the common animals and building up the stock industry, which was greatly depleted during the war.

Feeds for wintering and winter fattening of beef cattle in eastern Canada, G. W. Muir (*Canada Expt. Farms Exhibition Circ. 106, pp. 6*).—This is a discussion of the feeding value for beef production of feeds which can be grown in Ontario, Quebec, and the Maritime Provinces.

The feed requirements of pregnant and lactating ewes, N. Hansson (*Meddel. Centralanst. Försöksv. Jordbruksområdet, No. 235 (1922), pp. 23*).—The results of experiments with Shropshire ewes carried on at Bjärka Säby by the Swedish Agricultural Experiment Station from January 20 to May 16, 1922, have indicated that the feed requirements of ewes are lower than those suggested by O. Kellner, and that in calculating maintenance rations account must be taken of the increased requirements during pregnancy. On the basis of these results the daily requirements suggested for ewes per 100 kg. live weight were for the beginning of the winter feeding period 1 to 1.2 food units and 70 to 84 gm. of digestible protein, during the last month of pregnancy 1.3 to 1.5 food units and 110 to 128 gm. of digestible protein, and during lactation 1.8 to 2 food units and 180 to 200 gm. of digestible protein. The paper is summarized in English.

Dressing and cutting lamb carcasses, A. A. MacMillan and W. J. Howard (*Canada Dept. Agr. Bul. 8, n. ser. (1922), pp. 29, figs. 33*).—Directions for killing, dressing, and cutting lambs are given, with an extensive series of photographs showing the details of each step. A suggested method of cutting the carcass for distribution to the members of lamb rings is presented.

[Experiments with swine], G. B. Rothwell (*Canada Expt. Farms, Anim. Husb. Div. Interim Rpt., 1921, pp. 26–39, fig. 1*).—The comparative tests with swine carried on during the year ended March 31, 1921, are briefly reported.

Supplements for the sucking and weaning pig (pp. 26–28).—In comparing various feeds for suckling pigs, it was found that middlings and oats in equal

parts and skim milk made the most satisfactory ration. Other foods used as additions to this mixture were molasses, 5 per cent of blood meal, 5 per cent of fish meal, and 5 per cent of ground flax. Three lots of pigs were also fed on commercial pig meals with skim milk.

Commercial v. home mixtures for the fattening hog (pp. 28–32, 34).—Eighteen lots of pigs have been compared on home mixed and commercial feeds, with the result that in practically all cases the gains were made at less cost on the home mixed feeds. In most cases the gains were also made more rapidly.

[*Inside v. outside feeding*] (pp. 32–34).—Six lots of pigs fed outside were compared with 6 lots fed inside as to rate and economy of gains made. The inside-fed pigs made the most rapid gains and the quality of flesh seemed to be better. In 1 lot of experiments the inside gains were cheaper, but in the other test the reverse condition occurred.

The self-feeding method v. trough feeding (pp. 34, 35).—In comparing trough and self-feeding methods, it was found that more feed was required by using a self-feeder. However, there was a saving of labor and a saving of the time in finishing the pigs over the method of trough feeding.

Yorkshires v. Berkshires (pp. 36–38).—Comparisons of the economy of production, breeding qualities, and vigor of Yorkshires and Berkshires indicate that there is very little difference in the end results in either case. Berkshire sows were not quite as prolific as the Yorkshires, but the losses of pigs were sufficiently less to fully compensate for this difference.

Feed requirements and costs [*of raising pigs*] (pp. 38, 39).—The costs of raising and finishing a hog at 181 lbs. in weight were calculated at $19.59. The cost to 10 weeks of age was $4.07, and the balance was for growing and fattening after that time.

Feeding experiments with fattening pigs (1920–1922), C. C[rowther] (*Olympia Agr. Co. Ltd., Research Dept. Bul. 3 (1922), pp. 34, fig. 1*).—This bulletin gives the results of four experiments designed to compare various feeds as to the quantity and quality of pork produced by them. Five lots of barrows were used for the first test. Lot 1 received a ration consisting of 5 parts sharps and 3 parts barley. This ration was modified for the other lots by replacing 1 part of the barley, in lot 2 by 1 part of rice meal, in lot 3 by 1 part of fish meal, in lot 4 by 1 part of proprietary pig meal, and in lot 5 by 1 part of gluten meal. Some additional mangels were fed to all lots.

In the second experiment the ration of lot 1 consisted of 10 per cent of bran, 45 per cent of sharps, and 45 per cent of barley meal. One lb. per pig of green stuff was also fed daily. The ration of lot 1 was modified for the other lots as follows: Lot No. 2 no green stuff, lot 3 one-fourth of the barley replaced by fish meal, lot 4 same as lot 3 without green stuff, lot 5 one-half barley replaced by corn meal, lot 6 one-half barley replaced by proprietary pig meal, and lot 7 ½ oz. of cod liver oil fed per pig daily in place of the green feed. The pigs in lot 7 were not placed on test until the others had been on test for 6 weeks.

In the third experiment two lots of pigs received a ration of 1 part corn meal, 2 parts barley meal, and 3 parts palm kernel meal. In addition lot A received one-tenth to one-seventh as much fish meal, whereas lot B received no fish meal.

Three lots of pigs were fed in the fourth experiment, all lots receiving a basal ration of equal parts barley meal and sweetened palm kernel meal and one-seventh by weight of fish meal in lot A and two-sevenths by weight of haricot bean meal in lot C. The following table gives a summary of the results of the four tests:

Summary of pig feeding tests.

Experiment.	Lot.	Pigs per lot.	Length of test.	Average initial weight.	Average gain for period.	Feed consumed per pound gain.	Feed cost per pound gain.
		No.	*Days.*	*Lbs.*	*Lbs.*	*Lbs.*	*d.*
1	1	10	97	52.0	95.7	3.96	7.48
	2	10	97	54.9	83.4	4.31	7.49
	3	10	97	51.6	117.4	3.47	6.64
	4	10	97	52.9	87.6	4.22	7.63
	5	10	97	55.1	86.5	4.27	7.58
2	1	10	110	53.3	85.1	4.76	7.39
	2	10	110	52.9	86.2	4.42	6.81
	3	10	110	54.3	113.4	3.90	6.10
	4	10	110	54.6	122.2	3.56	5.55
	5	10	110	58.6	98.6	4.04	6.00
	6	10	110	54.0	86.7	4.00	6.01
	7	10	68	71.9	64.9	4.54	7.28
3	A	20	56	127.3	96.2	4.63	5.47
	B	20	56	132.8	79.4	5.31	5.40
4	A	20	77	66.8	126.2	3.88	4.83
	B	20	77	67.2	92.1	4.83	5.20
	C	20	77	68.3	66.1	5.75	5.98

Very little difference in the quality of the meat was shown in the different lots, and no taints to the flavor from the fish meal or cod liver oil feeding were observed.

Feeding of farm work animals, D. T. Gray and E. H. Hostetler (*N. C. Dept. Agr. Bul., Sept., 1922, pp. 15, figs. 2*).—Data which have been collected on the farm work horses and mules at the Iredell, Pender, and Edgecombe test farms in North Carolina during a period of 6 to 7 years are reported. These tests were planned to study the desirability of feeding cottonseed meal to work horses and mules, the comparative value of corn and oats and corn alone for work animals, the cost of raising a colt, and the number of hours farm horses worked yearly.

The cottonseed meal was fed in amounts up to 1.5 lbs. per head daily, 1 lb. replacing 2 lbs. of corn. No ill effects were observed on the horses, and the cost of the grain ration was cheapened when cottonseed meal was included. With the leguminous roughages fed in the tests, corn as the sole grain gave as good results as a mixture of corn and oats, equal parts. The records showed that the animals in these tests worked less than 50 per cent of the time.

Records were kept of the cost of raising a colt at the Iredell test farm. An average of $247.27 was required to raise a colt to maturity, which averaged 2 years and 7 months of age.

The history of horse breeding in the Palatinate Province and the establishment of the stud at Zweibrücken, E. Ehrensberger (*Jahrb. Wiss. u. Prakt. Tierzucht, 15 (1922), pp. 1–71, figs. 11*).—This is a review of the early history of horse breeding in the Palatine district from the time the European wild horse was found in that region. The earliest records indicate that there were a large number of horses of excellent quality kept in the district. In the fifteenth century a number of government studs were established, including the one at Zweibrücken which still exists and which has been largely responsible for the development of the good qualities in Palatine horses.

[Poultry experiments at the Canadian Department of Agriculture], F. C. Elford (*Canada Expt. Farms, Poultry Div. Interim Rpt., 1921, pp. 4–19, 21, fig. 1*).—Accounts of the experiments with poultry carried on during the year ended March 31, 1921, are briefly reported.

The incubation of chilled eggs (pp. 4–6).—Two hundred and forty White Leghorn eggs were chilled for various lengths of time and at different temperatures before incubation. The best hatch occurred from eggs which were packed for shipment and exposed for 5 hours at a temperature of 14° F., which gradually rose to 26°. This suggests that eggs will stand more cold than general information has indicated.

[*The cost of*] *brooding* (pp. 6, 7).—The cost of brooding 500 chicks in brooders heated by coal-burning stoves was determined as $2, by electroplanes $18.96, by radiator lamps $12.16, and by hens $5.25.

Feeding experiments [*with baby chicks*] (pp. 7–10).—Twelve lots of 42 chicks each, consisting mostly of White Leghorns, were fed a basal ration of commercial chick feed and dry mash consisting of equal parts of bran, middlings, and corn meal, with the addition of meat, milk, eggs, and greens separately and in combinations of 1, 2, 3, or all of the supplements in different lots. Based on the mortality and the growth made by the chicks, greens seem to be essential for maximum growth and vitality. Eggs, meat, and milk rank next in the order named.

Semisolid buttermilk [*for egg production*] (pp. 10–12).—The analyses of two samples of semisolid buttermilk are given, as well as the results of a 1-month test in which it was fed to one lot of 15 Leghorn pullets. Fresh buttermilk replaced semisolid buttermilk in the feed of another lot, and a third lot received no buttermilk. The average egg production per bird in the three lots was 17.4, 15.1, and 13.2 eggs, respectively. During the month of the test each lot received 73 lbs. of scratch grain costing $2.66. In addition, 15 qt. of semisolid buttermilk was consumed by the lot receiving it at a cost of $3.20, and the second lot received 93 qt. of fresh buttermilk at a cost of $1.15. The total feed costs of the lots receiving semisolid buttermilk, fresh buttermilk, and no buttermilk were $6.27, $4.45, and $3.17, respectively, the difference between the cost of scratch grain and buttermilk and the total cost being due to the dry mash, beef scrap, shells, and green feeds consumed.

Tankage as a substitute for beef scrap (pp. 12, 13).—In a comparative test of the value of different grades of tankage as substitutes for beef scrap it was found that samples of tankage containing 43 and 45 per cent of protein were profitable substitutes for beef meal in poultry feeding. Low-grade tankage containing 32 per cent was not profitable, however, since a much reduced egg production occurred.

Vegetable v. animal protein (pp. 13, 14).—Beef scrap was found to produce more rapid gains and more economical gains in fattening cockerels over a 12-day feeding period than soy bean meal combined with the same feeds to produce a ration having the same protein content.

Crate feeding (pp. 14–16).—Six lots of birds were fattened on rations, the nutritive ratio of which varied from 1:3.2 to 1:5.6, to compare wide and narrow rations for crate fattening. The results indicated that the low protein rations were most profitable except where tallow was included as a portion of the feed. Skim milk was found very desirable as an ingredient of the crate fattening ration.

Poultry mustard for laying hens (pp. 16, 17).—Three pens of Leghorn pullets receiving a standard basal ration when given 1 teaspoonful, 2 teaspoonfuls, and no poultry mustard daily laid, respectively, 31.8, 29.6, and 31.5 eggs. This showed no increase in egg production due to the mustard, but the cost of feed consumed was less, especially where 1 teaspoonful was fed.

Feeding pituitary gland substance (pp. 17–19).—In studying the effects of pituitary gland substance on poultry, 4 experiments were carried on. In the

first experiment 2 lots of White Leghorn hens received 0.33 gm. of pituitary gland substance each as pills or in a mash, and a third lot received none of the pituitary gland. The egg production of the two pens receiving the experimental material tended upward during the 10-day test period, while in the control pen the production tended downward.

In the second experiment 30 4- to 5-months-old Barred Rock pullets were divided into two lots, one of which received 0.33 gm. of pituitary substance per bird daily in the mash. At the end of the test 9 pullets in the latter pen were laying as compared with 5 pullets which were laying in the control pen. A total of 120 eggs were laid in the experimental pen, but only 43 were laid by the control birds.

Two pens of 10 White Leghorn pullets each were used in the third test, which was carried on during the four months, December, January, February, and March. The pens were fed as in the second experiment. The control lot laid 391 eggs as compared with 400 for the pituitary lot, and the 400 eggs were 18.7 per cent heavier than the 391 eggs.

The fourth experiment was similar to the third and the results were in agreement with it. It is concluded that the pituitary substance hastened maturity, but any stimulation to egg production which it might have exerted was of only short duration.

Electric light to increase production (p. 21).—Two years' experiments with electric lights showed that lighting increases the egg yield during the early winter, but that the total egg yield for the year is not so heavy. Early winter eggs, however, are usually the most profitable to produce.

Feeding and management of baby chicks, Mrs. G. R. Shoup (*Western Washington Sta. Bimo. Bul., 10 (1923), No. 6, pp. 132–136*).—The needs of baby chicks and desired conditions in the brooder are discussed, with a description of different feed mixtures and the amount of each to feed from hatching until 8 weeks of age.

Raising healthy pullets, G. R. Shoup (*Western Washington Sta. Bimo. Bul., 10 (1923), No. 6, pp. 128–130, fig. 1*).—The difficulties from soil contamination in rearing chicks led to the spreading of 4 or 5 in. of coarse gravel over a strip 16 ft. wide across the front of a brooder. Very satisfactory reduction of losses from internal parasites resulted.

Fattening poultry for table purposes, S. W. Nash (*Union So. Africa Dept. Agr. Jour., 5 (1922), No. 5, pp. 447, 448*).—At the Grootfontein School of Agriculture in Cape Province 9 White, 4 Brown, and 4 Black Leghorn; 5 White Orpington; 1 very old Indian Game; and 1 White Wyandotte cockerels were crate fattened for 18 days on daily rations consisting of 3½ oz. per bird of a mixture of 3 parts corn meal and 1 part pollard which was mixed with skim milk to make a thin paste. The cockerels of the light breeds made average gains during the period of 1 lb. and 3 oz. and the heavy breeds 1 lb. and 12 oz. The quality of the meat was also much improved over birds not specially fattened. The extra cost was calculated at only 1d. per bird.

The function of the gizzard, W. Hicks (*Natl. Poultry Jour., 3 (1923), Nos. 142, pp. 531, 532; 143, pp. 547, 548*).—This is a discussion of the function of the gizzard, which the author states is mainly to grind up the fiber which the birds consume. The softer materials of the food are first ground up and passed into the intestines, and then the fiber in a more or less dry state is ground by the pressure of the gizzard muscles with the grit, until the resulting material is sufficiently fine to enter the intestines. It is suggested that the grit furnished to fowls should be smooth to prevent injury to the walls of the gizzard, which may result from sharp grit.

DAIRY FARMING—DAIRYING.

The Scandinavian fodder unit, D. W. STEUART (*Scot. Jour. Agr., 5 (1922), No. 4, pp. 410–414*).—This is a review of the history and development of the Scandinavian fodder unit. At a conference in 1915 the Scandinavian countries agreed that 1 kg. of barley would be considered as the standard. Modifications as to the fodder value of different feeds from time to time and the modified standards for milk production used previous to, during, and since the war are presented. The present milk testing associations are constantly adding new material of value to the feed requirements for milk production by making the testers report not only the milk and fat produced but also the feed consumed.

Feeding mineral matter to dairy cattle, C. W. TURNER (*Jersey Bul. and Dairy World, 42 (1923), No. 13, pp. 610, 645–647*).—This is a review of experiments dealing with the mineral requirements of dairy cattle, based mainly on the works of E. B. Forbes, E. B. Meigs, and E. B. Hart.

Experiments in feeding calves with "Kisso" instead of sweet milk and with whey instead of skim milk, H. GOLDSCHMIDT (*K. Vet. og Landbohøjsk. [Copenhagen], Aarsskr. 1922, pp. 85–109*).—In a number of experiments with calves Kisso, which is a commercially prepared feed, was fed in combination with skim milk with or without water, and the growth made by the calves was compared with the growth made by calves receiving whole milk. It was found that during the periods when the Kisso was being fed (seventh to forty-sixth day) the increase in weight was not so great as with whole milk, but at 6 months of age the size of the calves was not distinguishable from those which had received the whole-milk diet. Certain difficulties were encountered with the Kisso feeding, however, such as frequent digestive disorders resulting in diarrhea, and the necessity of extreme accuracy in weighing and mixing Kisso with the skim milk and water.

In other experiments in which whey was compared with skim milk it was found that 1 kg. of whey plus 0.25 kg. of skim milk would produce the same body growth in calves from ½ to 3½ months of age as 1 kg. of skim milk. The nutritive value of whey was determined as about two-thirds the value of skim milk. An English summary of the experiments is given.

Dairy calf raising up to date, H. E. MCNATT (*Western Washington Sta. Bimo. Bul., 10 (1923), No. 6, pp. 123–126*).—After reviewing several experiments on calf feeding the author concludes that there is no satisfactory substitute for milk for young calves, although by getting a good start weaning may take place at from 50 to 70 days of age.

Twenty-one years of dairy cattle breeding, O. H. BERGH (*Hoard's Dairyman, 65 (1923), No. 11, p. 402, fig. 1*).—The progress of dairy cattle breeding at the Minnesota North Central Substation is briefly reviewed, with special reference to the period after 1907, when a purebred Guernsey sire was first employed. By disposing of the poorer females and using better bulls the production of the herd has been markedly increased.

The true type of the Holstein-Friesian breed, M. S. PRESCOTT (*Holstein-Friesian World, 20 (1923), No. 13, pp. 610, 611, 636, figs. 11*).—Models and paintings of the ideal type bull and cow of the Holstein breed have been approved by a committee of nine recognized judges, replicas of which, it is announced, will be lent to land-grant colleges for use in animal-husbandry work.

The water buffalo for dairy purposes, C. O. LEVINE (*Lingnaam Agr. Rev., 1 (1922), No. 1, pp. 1–30, pls. 5*).—Data on the milk and fat production and adaptability of the water buffalo for dairy purposes are given, most of which were previously reported (E. S. R., 46, p. 577). In addition data are presented

on the gestation periods of 15 calves, weights of 18 calves at birth, and weights of their dams and sires. The average birth weight of the calves was 67.7 lbs. The gestation period varied from 332 to 363 days, the average being 343.2 days. The bull calves were carried a little longer—347.3 days—and averaged 69 lbs. in weight, whereas the average gestation period of the heifers was 338.6 days and the birth weight 66.1 lbs.

The reconstruction of Alberta's dairy industry (*Agr. Gaz. Canada, 10 (1923), No. 2, pp. 131–134*).—During the war and just following, the quality of the butter produced in Alberta deteriorated greatly. In 1917, 56 per cent of the butter produced was graded in the special class, but in 1921 only about 8 per cent was placed in this class. By means of systematic grading of the cream under the direction of the Government 26.8 per cent of the butter produced in 1922 was of sufficient quality to be placed in the highest grade.

The effect of temperature on the percentage of fat in milk.—A first report, A. C. Ragsdale and S. Brody (*Jour. Dairy Sci., 5 (1922), No. 2, pp. 212–215, fig. 1*).—During March and April, 1921, at the Missouri Experiment Station, the fat percentage in the milk of 10 cows and the daily environmental temperatures were recorded. These data showed a relationship between the temperature and fat percentage in which an increase of about 0.2 per cent in fat was found to occur for a decrease of 10° F. in environmental temperature.

The seasonal variations of the percentage of fat in cow's milk, A. C. Ragsdale and C. W. Turner (*Jour. Dairy Sci., 5 (1922), No. 6, pp. 544–554, figs. 3*).—Using the data employed in a previous paper (E. S. R., 48, p. 78), the authors have found that the season of the year exerts a greater influence on the fat percentage in the milk than the advance of the lactation period.

"In general it may be said that no matter when the lactation period begins, there is a tendency for the percentage of fat to rise above the average during the winter months, especially December, January, and February, and then to gradually decline during the spring and summer, reaching the lowest point during June, July, and August. These seasonal variations have been shown by Ragsdale and Brody [see above] to be due to environmental temperature."

The fat and dry matter content of milk produced in Norrbotten [Sweden], E. Hannerz (*K. Landtbr. Akad. Handl. och Tidskr., 61 (1922), No. 8, pp. 672–680, figs. 3*).—A study of the fat and dry matter content of 125,018 samples of milk produced in Norrbotten by grade cows from 1897 to 1920 is reported. The fluctuations in yearly production have been plotted graphically with the fluctuations in composition.

The heat coagulation of milk, H. H. Sommer and E. B. Hart (*Jour. Dairy Sci., 5 (1922), No. 6, pp. 525–543*).—In continuing the study of the cause of coagulation during sterilization of evaporated milk (E. S. R., 42, p. 208), the addition of small amounts of solutions of sodium citrate, sodium phosphate, calcium acetate, or sodium bicarbonate has been found to prevent coagulation of the fresh and evaporated milk at the temperatures necessary for sterilization. To determine the action of the salts in preventing coagulation several experiments were carried on.

The time required for coagulating samples of milk of different acidity but from the same cow showed that with an increased acidity or with the addition of calcium acetate the coagulation was prevented at 137° C., whereas fresh samples would coagulate in about 2½ minutes at this temperature. Only very slight changes in acidity accompanied the addition of calcium acetate to the samples. By changing the reaction of a solution of casein in lime water by the addition of hydrochloric acid alone or hydrochloric acid and sodium citrate

it was conclusively demonstrated that sodium citrate has an effect in keeping the casein in solution which is not due to the reaction of the solution. This experiment was carried on both at room temperature and at a temperature of 137°.

In studying the effect of the balance between sodium phosphate and calcium chlorid, sodium citrate and calcium acetate, and dipotassium phosphate and calcium acetate in the casein solution, it was found that when the calcium salts were in excess coagulation occurred very quickly at 137° in the solution.

Bitter milk of advanced lactation.—A lipase fermentation, L. S. PALMER (*Jour. Dairy Sci., 5 (1922), No. 2, pp. 201–211*).—In experimental studies of the cause of bitter milk which is often produced by individual cows toward the end of lactation, samples of bitter milk varying from 1 drop to 7 cc. were added to 17.6 cc. of fresh pasteurized sweet cream which was held at different temperatures. The characteristic bitter flavor developed in the cream when the larger amounts of bitter milk were added to it, but no effect was evidenced from the addition of the smaller amounts. Heating the bitter milk to 72° C. before adding it to the cream also destroyed its power to produce the rancid flavor, even when the cream was held at room temperature.

When small amounts of an aqueous solution of butyric acid were added to fresh milk, the characteristic bitter flavor was produced. The author has concluded that the immediate cause of bitter flavor is the action of an abnormal amount of lipase in the milk. In samples of bitter milk to which chloroform or formalin were added to prevent bacterial growth, the acidity of the sample developed much more rapidly than in normal milk or in similar samples of bitter milk which had been heated to 72° for 30 seconds. The results all tend to indicate that an extraordinary amount of an active lipase in the milk is the primary cause of the production of the bitter flavor. This enzym tends to hydrolyze the milk fat with the liberation of volatile fatty acids, especially butyric, which is itself responsible for the bitter flavor and rancid odor of the milk and also possibly of rancid butter. The action of the enzym can be prevented by heating the milk to 75° for a few minutes.

The influence of the physical condition of the cream fat on the resulting butter, W. VAN DAM (*Milchw. Zentbl., 52 (1923), Nos. 1, pp. 1–4; 2, pp. 13–16*).—A series of 11 experiments were carried on in which comparative samples of cream were churned. The cream was cooled to 0° C., after which one-half of it was heated to 40° for ripening and the other half was held at the lower temperature. Comparative samples were churned at temperatures varying from 11.7 to 22°, and the time required for churning and the percentage of fat in the buttermilk were determined. In one test the acidity of the samples varied considerably, but this had practically no influence on the time required for churning.

The results of the tests were somewhat variable, but less fat occurred in the buttermilk when the cream was not heated, though the time required for churning was often longer in this case, especially at the lower churning temperatures. Increases in the temperature of churning tended to reduce the fat in the buttermilk.

Preliminary experiments on the acidity as related to the composition and fishy flavor of butter, E. HAGLUND and E. WALLER (*K. Landtbr. Akad. Handl. och Tidskr., 61 (1922), No. 5, pp. 435–456*).—Preliminary experiments indicating that fishy flavor in butter is due to an increased acidity are reported. Based on this assumption, the authors suggest various methods of reducing the acidity of the moisture in butter by increased working or by leaving the butter in water for 2 hours before removing from the churn. Other factors, such as a

difference in the composition of the cream, did not have any effect on the composition of the butter.

The cheese of Spanish ewes, TRIPTOLEMO (*Prog. Agr. y Pecuario, 28 (1922), No. 1250, pp. 344–347*).—The production and characteristics of the cheeses produced in the Provinces of La Mancha, Ciudad Real, Albacete, and Badajoz are described.

Cheddar cheese making, J. P. GOW (*Union So. Africa Dept. Agr. Jour., 6 (1923), No. 2, pp. 122–136, figs. 7*).—The process of manufacturing Cheddar cheese is described and the common defects noted.

What is necessary for the profitable production of Swiss cheese in our country [Sweden]? P. SYLVAN (*K. Landtbr. Akad. Handl. och Tidskr., 61 (1922), No. 5, pp. 408–412*).—The conditions under which Swiss cheese is produced in Switzerland are described and compared with the conditions in Sweden. Since the larger cheeses are less susceptible to changes in environment, it is suggested that the imitation Emmenthaler cheese be produced in sizes of 100 kg., as in Switzerland, instead of the 15-kg. cheeses which it is customary to produce in Sweden.

Structure of powdered milk and its possible relation to the keeping quality of whole milk powders, L. S. PALMER and C. D. DAHLE (*Jour. Dairy Sci., 5 (1922), No. 2, pp. 240–245, figs. 3*).—The structure of whole milk powder made by the spray and drum methods is described, and it is shown that a bubble of air is incorporated in the particles made by the spray method. The inferior keeping quality of spray process whole milk powder is ascribed to oxidation, which is greater because of the air inside as well as outside of the particles.

Bacterial content of milk powder, G. C. SUPPLEE and V. J. ASHBAUGH (*Jour. Dairy Sci., 5 (1922), No. 2, pp. 216–228, figs. 4*).—The bacterial counts of powdered milk made by the Just process were shown to vary from different factories, and a lack of relationship was found between the bacterial content of powdered milk and the fresh milk from which it was made. Varying amounts of bacterial contamination were found to occur during sifting and packing. In 43 samples of powdered milk containing amounts of moisture varying from 1.74 to 9.34 per cent, the bacterial content was found to decrease as the period of storage increased. These counts were made of the fresh milk and of the powdered milk after it had been stored 2, 4, 6, 8, 10, and 12 months. Milk powder artificially inoculated and stored showed similar results. Graphs are presented which show the death rate of bacteria in powdered milk containing different amounts of moisture.

Bacteria counts of milk powder as obtained by the microscopic method, G. C. SUPPLEE and V. J. ASHBAUGH (*Jour. Dairy Sci., 5 (1922), No. 6, pp. 570–582*).—As in the above study comparative bacterial counts made by the microscopic method of reconstructed powdered milk dried by the Just process and the raw milk from which it was made showed that the powdered milk contained less bacteria than the raw milk in most cases. The average coefficient of variability of bacterial counts of samples of normal milk was 46.3 per cent and only 32.7 per cent for the powdered milk samples. The general results of the work indicate that the microscopic method of determining bacteria in powdered milk gives results which are fully as uniform as those obtained in natural milk. Old insoluble samples of powdered milk, however, may not give as good results.

Dairy factories, 1921 (*Canada Bur. Statis., Dairy Factories, 1921, pp. XV+67*).—This is a statistical review of dairying in Canada as a whole and by provinces during 1921, with some comparative statistics for 1919 and 1920.

Among the data reported are the number of cows, amount and value of milk, cream, and manufactured dairy products produced, and capital invested and expenses of the dairy factories.

VETERINARY MEDICINE.

Handbook of parasitology, J. GUIART (*Précis de Parasitologie. Paris: J.-B. Baillière & Son, 1922, 2. ed., rev., pp. XII+575, figs. 462*).—This is a revised edition of the work previously noted (E. S. R., 23, p. 785).

Notes on mange and allied mites for veterinarians, A. W. N. PILLERS (*London: Baillière, Tindall & Cox, 1921, pp. XII+110, figs. 68*).—This is a handbook on the parasitic mites.

Contributions to the biology of Taenia crassicollis and Cysticercus fasciolaris, H. O. SCHMIT-JENSEN (*K. Vet. og Landbohøjsk. [Copenhagen], Aarsskr., 1921, pp. 91–129, fig. 1*).—In studies and observations made during the course of investigations conducted with a view to determining the causal relationship between *C. fasciolaris* and sarcoma formation in rats, only negative results were obtained, the development of sarcoma neither being demonstrated nor produced in any case. In work including infestation of about 100 rats with cysticerci and observation of the animals for months or years till death took place from age or disease, the autopsies never revealed any tumors. After implantations of one or more live, free cysticerci into the abdominal cavities of about 25 rats, resorption of the parasites took place in all cases, followed by more or less pronounced encystment phenomena.

In studying the normal cycle of the parasite, it was found that young cats about 30 days of age and still sucking are most susceptible to infestation and serve as good tapeworm hosts. With young white mice it was found that more than one-half escape infestation. In experiments with rats two strains were used, a gray and white strain (*Mus decumanus* variety) and a black and white strain (*M. rattus* variety), both strains being equally susceptible to infestation.

The paper includes a list of 43 references to the literature.

Effects of extracts of Ascaris vitolorum on experimental animals, B. SCHWARTZ (*Philippine Jour. Sci., 22 (1923), No. 1, pp. 109–114*).—"Physiological salt solution extracts of *A. vitolorum* were found to be toxic to guinea pigs and rats and nontoxic to frogs and to a turtle. Toxic symptoms were provoked in susceptible animals by injecting them intraperitoneally with extracts of this worm and in one case by administering an extract by mouth. In one experiment an extract was still toxic after having been boiled. The symptoms exhibited by susceptible animals injected with extracts of *A. vitolorum* were heightened excitability, followed by a state of dullness and prostration that led to fatal termination in several instances. There was a decided similarity in symptoms exhibited by calves normally parasitized by *A. vitolorum* to those provoked in susceptible animals to which extracts of that parasite were administered. The data presented in this paper afford more conclusive evidence in favor of a chemical pathology in a specific helminthic disease than has been offered heretofore."

Miscellaneous tests of carbon tetrachlorid as an anthelmintic, M. C. HALL and J. E. SHILLINGER (*Jour. Agr. Research [U. S.], 23 (1923), No. 3, pp. 163–192*).—Following a brief historical account of the use of this chemical, the authors report briefly upon tests made with turkeys, chickens, rabbits, dogs, cats, foxes, swine, horses, sheep, cattle, monkeys, and man, respectively. The results have been summarized as follows:

"Carbon tetrachlorid has a pronounced selective action on bloodsucking worms, as shown by its high efficacy against hookworms in dogs, foxes, cats,

sheep, and cattle; Strongylus in the horse, stomach worms in sheep and cattle, and Nematodirus in sheep. It has a high efficacy against ascarids in dogs, cats, foxes, swine, and horses, being less effective, apparently, than chenopodium against ascarids in swine and more effective against ascarids in horses. It is less effective than chenopodium against ascarids in man, but its approximate efficacy for the doses used can not be stated at present. It is not effective in removing pinworms from horses, but evidently has some efficacy against the related heterakids of monkeys and of birds. It will remove some pinworms from man in many cases, but its approximate efficacy can not yet be stated. It is inferior to chenopodium for removing cylicostomes from horses, but is much superior to any drug yet tested for removing small trichostrongyles from sheep. It will remove some nodular worms from sheep, but it exhibits a variable efficacy in this connection, removing none in 2 cases, 3 per cent in 1 case, 64 per cent in 1 case, and 100 per cent in 1 case. In the large doses used on cattle it removed all the nodular worms present. In view of the results obtained and the apparent tolerance for large doses of this drug which some species of animals show, it may prove possible to remove whipworms from some species of animals with this drug by giving doses so large that their bulk will in most cases insure the entrance of this drug into the cecum. One hundred per cent efficacy was obtained in some cases in removing whipworms from dogs, sheep, and cattle.

"Carbon tetrachlorid is inferior to carbon bisulphid for the removal of bots, but is superior to any drug other than this which has been tested against bots. Carbon tetrachlorid is not of value in removing tapeworms from chickens, dogs, sheep, cattle, or man, and will probably be of little value against tapeworms in any animals. . . . Its value in removing spirurids and Capillaria from chickens is problematical and requires further investigation. Carbon tetrachlorid has not been tested on such forms as the common liver fluke (*Fasciola hepatica*). . . .

"Many patients report no symptoms following the oral administration of carbon tetrachlorid in therapeutic dose. Of the symptoms reported the most common appear to be a transient dizziness, slight headache, and a sensation of weight, warmth, or slight discomfort at the stomach. Other symptoms which are sometimes manifested are tingling or burning sensations and drowsiness. Rarely, usually following the administration of rather high doses, the drug may cause nausea, vomition, irregularity of pulse, and slurring speech."

A list is given of 29 references to the literature cited.

Observations on the complement fixation reaction in liver fluke (Fasciola hepatica L.) infection, N. H. Fairley and F. E. Williams (*Jour. Path. and Bact., 26 (1923), No. 1, pp. 19–26*).—Studies here reported have led the authors to draw the following conclusions:

"Histological studies show that flukes exert a definite toxic action on the parenchyma and connective tissue cells of the liver, inducing an inflammatory response characterized by a predominant eosinophile cellular infiltration perhaps running on to small focal abscess formations. The serological response in hepatic distomiasis of sheep (*F. hepatica*) is characterized by the appearance of specific antibody in the peripheral blood of the definitive host. Phenol-saline and alcoholic extracts of fresh flukes (*F. hepatica*) possess true antigenic properties. The value of different extracts varies markedly, and in performing the reaction several different antigens should be prepared and standardized. The most suitable should be selected for routine diagnosis. By employing the technique described in the test, 14 out of 20 sheep infested with *F. hepatica* yielded definitely positive reactions, 2 yielded partial positive results, and 4 were negative. The sera obtained from normal animals and

from sheep infested with hydatid or lungworm yielded negative results. We recommend an extension of this method to the diagnosis of *Clinorchis sinensis* infestations of man and suggest that its greatest sphere of usefulness will be found in affording an index to the therapeutic effect of drugs on the parasites themselves."

Vaccine and serum therapy in veterinary practice, L. C. MAGUIRE (*London: Baillière, Tindall & Cox, 1922, pp. VIII+127*).—This small volume explains in simple terms the general principles of immunity and the application of these principles in veterinary practice. Under the latter head the diseases discussed are classified as diseases produced by bacteria which secrete true toxins, diseases presumably caused by ultramicroscopic organisms, acute diseases produced by miscroscopic organisms, chronic infectious diseases, and bacterial diseases of the central nervous system.

Protein therapy and nonspecific resistance, W. F. PETERSEN (*New York: Macmillan Co., 1922, pp. XVII+314, figs. 7*).—This volume consists of a comprehensive analytical review of the subject of protein and nonspecific therapy in sections dealing, respectively, with the method, theories, and clinical results. The last-named section concludes with a chapter on indications and contraindications for the use of protein therapy. A classification of the proteins and their split products is given in an appendix, and an extensive bibliography is included.

Practical aspects of blackleg immunization, W. N. BERG (*Jour. Amer. Vet. Med. Assoc., 62 (1923), No. 5, pp. 607–622*).—This paper consists essentially of descriptions of the various products at present employed in blackleg immunization and a comparison from data reported in the literature of the immunizing potency of blackleg filtrates and aggressins. From these data the conclusion is drawn that blackleg filtrates have been prepared with higher potencies than aggressins, and that the potency of the 30-day blackleg filtrate is higher than that of any other blackleg immunizing product at present available.

Paratuberculous antigen and the fixation reaction in the tuberculosis of domestic animals, J. VERGE (*Compt. Rend. Soc. Biol. [Paris], 88 (1923), No. 3, pp. 185, 186*).—Further evidence is given of the nonspecificity of the complement fixation test for bovine tuberculosis as previously noted (E. S. R., 48, p. 879). Practically no difference was found between the results of complement fixation tests with sera of tuberculous cattle, dogs, and cats, using the methyl alcohol extract of tubercle bacillus and a similar extract of the organism of paratubercular enteritis (Johne's disease).

The fixation reaction in the diagnosis of tuberculosis in domestic carnivorous animals, J. VERGE (*Compt. Rend. Soc. Biol. [Paris], 88 (1923), No. 5, pp. 325, 326*).—The complement fixation reaction with the methyl antigen of Boquet and Nègre and with the Besredka antigen was positive in 8 dogs with generalized tuberculosis and negative in 13 nontuberculous dogs. Of the 9 positive cases 7 gave a positive and 2 a doubtful tuberculin test. A cat suffering from skin tuberculosis gave a negative fixation test. The author concludes as the result of his observations that there is no relation between the intensity of the reaction to tuberculin and the richness of the serum in antibodies, but that a certain parallelism exists between the intensity of the tuberculous lesions and the number of antibodies.

Tuberculization by a double local reaction, R. PAQUOT (*Rec. Méd. Vét., 98 (1922), No. 24, pp. 545–551, figs. 3*).—In the suggested method for the tuberculization of cattle, 1 cc. of crude tuberculin in $\frac{1}{10}$ dilution is used, of which two drops are taken for each of two simultaneous intradermal subcaudal injections at a distance of 1 cm. apart, and the rest for an intrapalpebral injec-

tion as in the intrapalpebral mallein test. The readings for both are taken after a 48-hour interval. The method is said to be as simple and rapid as the classic intradermal test and to be much more certain.

The intestinal flora in mouse typhoid infection, L. T. WEBSTER (*Jour. Expt. Med., 37 (1923), No. 1, pp. 21–32, fig. 1*).—The studies reported in this and the following paper form a part of the general investigation of an epizootic of mouse typhoid previously noted (E. S. R., 48, p. 84), and constitute an attempt to analyze the factors other than the mere presence of the organism necessary to induce mouse typhoid. As the first step in this investigation, a study was made of the intestinal flora of laboratory mice under normal conditions and after artificial infection with a strain of *Bacillus pestis caviae.*

The normal flora of the mice when fed a bread and milk diet was found to consist chiefly of *B. acidophilus* and *B. bifidus,* which outnumbered the *B. coli, B. acidi lactici,* and *B. coli communior* group about 25:1. This flora did not change when the mice were infected with mouse typhoid bacilli, and was the same in animals resisting the infection as in those which succumbed.

Mice which were fed a meat diet showed a bacterial flora predominating in *B. coli, B. diffluens,* and *B. welchii,* but did not differ in susceptibility to mouse typhoid from the animals fed on bread and milk and showing a typical acidophilus flora.

Ox bile sensitization in mouse typhoid infection, L. T. WEBSTER (*Jour. Expt. Med., 37 (1923), No. 1, pp. 33–42, fig. 1*).—In the experiment reported in this paper, it was found that ox bile administered in doses large enough to cause diarrhea increased somewhat the susceptibility of mice to mouse typhoid infection. This is thought to confirm Besredka's conclusions that bile injures the intestinal epithelium, thus allowing bacteria to gain access to the blood stream (E. S. R., 43, p. 473). "But while host susceptibility to typhoid infection may be altered by injury to the intestinal epithelium, experiments so far have failed to justify his claim that all immunity to typhoid, paratyphoid, and dysentery infection, natural or acquired, is localized in the intestinal tract. On the contrary, in individual susceptibility and in acquired immunity to mouse typhoid infection, the intestinal wall is but one factor in a general mechanism."

Bovine infectious abortion and associated diseases of cattle and newborn calves (*California Sta. Bul. 353 (1923), pp. 267–397, figs. 12*).—This account consists of a number of papers which deal with the various phases of the subject, as follows: Methods of Controlling Abortion, by G. H. Hart (pp. 271–293); The Importance of *Bacterium abortum* of Bang and Other Microorganisms in Bovine Infectious Abortion, by J. Traum (pp. 294–325); Manifestations of Abortion Disease without Demonstrable Etiological Factor, by Traum and Hart (pp. 326–346); Diseases of the Genital Tract of Cattle Frequently Associated with Abortion, by F. M. Hayes (pp. 347–366); The Diagnosis of Pregnancy in Cattle, by Hart (pp. 367–379); and Scours and Pneumonia in Calves, by Hart and Traum (pp. 380–392). A list of 91 references to the literature and a glossary are appended.

The practical control of infectious abortion in cattle, J. W. CONNAWAY (*Missouri Sta. Bul. 201 (1923), pp. 3–11*).—This is a practical summary of information on infectious abortion in cattle, in which it is shown how such knowledge may be used to prevent and eradicate the disease.

Studies on bovine influenza, H. FUTAMURA (*Jour. Japan. Soc. Vet. Sci., 1 (1922), No. 3, pp. 133–142, pl. 1*).—In studies by the author a bipolar bacillus was isolated from saliva, the nasal discharge, and the internal organs of animals affected with influenza. The organism appeared to be highly virulent

for mice, guinea pigs, rabbits, sheep, and cattle. Antibodies specific for the organism were found present in the blood of cattle affected with the disease. Serum from the hyperimmunized animals was found to have a curative value.

The Preisz-Nocard bacillus in ovine pathology, H. CARRÉ (*Rev. Gén. Méd. Vét., 32 (1923), No. 373, pp. 1–12*).—This is an account of the author's experience in the control of ulcerative lymphangitis in sheep.

The intrapalpebral injection of an extract of cultures of the Preisz-Nocard bacillus is considered an excellent test for the detection of latent forms of the disease. The injection made in the usual way is said to cause the appearance in infected sheep of a more or less marked edema in about 12 hours. The reaction reaches its maximum in from 15 to 24 hours and disappears generally in from 36 to 40 hours. It is emphasized that even a slight edema must be considered an indication of the presence of an infection. Concrete examples are given of the use of this test as a diagnostic method of procedure.

In vaccination the best results have been obtained by the subcutaneous injection at 15-day intervals of two vaccines of graduated strength. This is said to produce no ill effects beyond a slight local action.

Treatment for stomach worms of sheep, G. A. BROWN (*Michigan Sta. Quart. Bul., 5 (1923), No. 3, pp. 134, 135*).—A two-year test of copper sulphate, as recommended by Hall and Foster (E. S. R., 38, p. 883), has shown it to give good results in controlling stomach worms of sheep.

A preliminary report on hog lungworms, G. ZEBROWSKI (*Ind. Acad. Sci. Proc., 1921, pp. 265–281, figs. 4*).—This is a report of investigations of the life history and habits of the common hog lungworms (*Strongylus*) *Metastrongylus apri* (*S. paradoxus*) and *M. brevivaginatus*, which occur in about equal numbers in Indiana hogs, and was conducted with a view to discovering some practical means of control. The author's observations have led him to conclude that these parasites are of much greater importance in swine economy than heretofore supposed.

In work with possible intermediate hosts, such insects and other invertebrates as are commonly found in hog runs and wallows were studied, the results in all cases being negative. In experiments with rats, two were fed lesions containing lungworms at intervals of 1 week for a period of 4 weeks, and two others were fed larvæ in advanced stages of development at approximately the same intervals for a period of 10 weeks. The first two were killed after 1 month and found free from infestation, but the latter pair, which were killed three months after the first and 2 weeks after the last feeding, showed very typical verminiferous lesions in both posterior lobes of the lungs, numerous dead larvæ and cast skins being found with them. It is concluded from these experiments that *M. apri* and *M. brevivaginatus* have no intermediate hosts, but that active, growing larvæ may occasionally invade the lungs of another animal than the hog.

The investigations have demonstrated that young larvæ feed within the soil, for they made no appreciable growth in the sterile plats until such time as seeds were planted and had begun to sprout. The larvæ were most active at temperatures ranging from 35 to 40° C. (95 to 104° F.). Too much and too little moisture were both detrimental. In experiments with digestive ferments, partly developed larvæ were much more resistant to their action than larvæ that had just hatched. Freezing appears to kill all stages of development, but experiments with desiccation have shown that 2-week-old larvæ can stand prolonged drying without injury, such larvæ being revived by placing them in water 3 months after they had been permitted to dry out in the soil at room temperature. It is pointed out that, in order to effect control, preventive

measures such as changing the site of the hog lot every three years must be depended upon rather than curative measures.

Reference is made to the account of Herms and Freeborn, previously noted (E. S. R., 35, p. 182), who report the work of Von Linden.

The leucosis of fowls and leukemia problems, V. Ellermann (*Høns-Loukosen i Komparativ-Patologisk Belysning. Copenhagen: Univ. Bogtryk., 1920, pp. (5)+98, pl. 1, figs. 12; also London and Copenhagen: Gyldendal, [1921], pp. IX+108, pls. 9, fig. 1*).—Following the presentation of a historical survey, a discussion of etiological theories, and technical remarks the chapters deal, respectively, with blood and blood-forming organs in normal fowls (pp. 27–30), the virus of the leucosis of fowls (pp. 31–42), the lymphatic leucosis (pp. 43–53), the myeloic leucosis (pp. 54–72), the intravascular lymphoid leucosis (pp. 73–88), etc. A bibliography of 106 titles is included.

Experimental studies on avian diphtheria, N. Nakamura (*Jour. Japan. Soc. Vet. Sci., 1 (1922), No. 3, pp. 123–132, pls. 2*).—In the investigations by the author a coccobacillus was isolated from the local lesions in the earlier stage of avian diphtheria, which appeared to be a causative agent. Treatment with the serum taken from the animals hyperimmunized against this organism gave uniformly favorable results in preventing the disease.

The colon-typhoid intermediates as causative agents of disease in birds.—II, Atypical organisms, H. G. May and H. A. M. Tibbetts (*Rhode Island Sta. Bul. 191 (1923), pp. 3–42*).—This second part of the account previously noted (E. S. R., 40, p. 685), reports upon studies made of organisms obtained in sporadic outbreaks of disease, and which have never been known to cause epidemics involving a number of flocks. A study of eight bacterial cultures isolated from diseased poultry showed that they were not closely related to each other, and that most of them were also not closely associated with any group of known pathogens. A culture which was at one time regarded as belonging to the fowl cholera group showed definite relationships to *Bacterium suipestifer*. Another culture obtained from Kral's laboratory as *Bacillus septicaemiae* (Latschenko), Grimm, must be regarded as an atypical *Bacterium gallinarum*, and another obtained from the same laboratory as the bacterium of fowl cholera showed definite relationship to *Bacillus cloacae* in the proteus group. Two of the cultures showed relationship only to the *B. coli* group, but both were readily distinguished from the ordinary *B. coli*. Two other cultures showed similar relationships to the *B. acrogenes* group. An additional culture lay intermediate between *Bacterium pullorum* and *B. coli*, and may readily be placed in one of the *Bacterium aracoli* groups.

The details of the investigations, presented in tabular form, are appended, and a bibliography of 40 titles is included.

The swine erysipelas bacillus as the cause of a chronic affection of poultry, F. Pfaff (*Ztschr. Infektionskrank. u. Hyg. Haustiere, 22 (1921), No. 3–4, pp. 293–298*).—Attention is first called by the author to the reports of Schipp in 1910 (E. S. R., 25, p. 785) and of Broll in 1911 (E. S. R., 24, p. 680), who found a septicemic disease of the hen to be caused by the swine erysipelas bacillus. Schipp reported the death of a large number of fowls in a short time in which a post-mortem examination showed only enteritis and a parenchymatous degeneration of the heart muscle, and in which the causative agent could not be distinguished from the erysipelas bacillus. Broll recorded an outbreak in which all the fowls in a flock succumbed within some weeks. The organism has been found by Jarosch to cause disease in the turkey and by Poels in the pigeon and duck.

In an outbreak observed on a farm, young fowls of from one to three weeks of age were affected, the disease lasting from two to five weeks; fowls of two to

three months of age or older seemed to be largely resistant to it. The author's investigations have shown that it is due to a pure infection of the swine erysipelas bacillus. He considers it desirable to conduct investigations with a view to determining whether the disease in fowls can not be prevented through the use of serum.

RURAL ENGINEERING.

Return of seepage water to the lower South Platte River in Colorado, R. L. PARSHALL (*Colorado Sta. Bul. 279 (1922), pp. 3–72, pl. 1, figs. 23*).—The results of a study of the return of seepage water after diversion to the South Platte River between Kersey and Julesburg, conducted under a cooperative agreement between the U. S. D. A. Bureau of Public Roads, the Colorado Experiment Station, the Colorado State engineer, and the counties of Water Districts Nos. 1 and 64 of Colorado, are reported. The purpose of the study was to determine the extent and distribution of such return waters, the periods of maximum and minimum return flow, and various other phases relative to the problem.

The term "waste water" is used to indicate surplus or excess water diverted from the stream and later intentionally returned. The term "run-off water" is used to indicate surface water supplies resulting directly from precipitation.

The results are based upon the assumption that the inflow streams tributary to the river of practically measurable volumes are either waste waters or natural run-off, while that portion of the supply entering the river channel from water-bearing strata is water originally diverted at higher points.

No attempt was made to distinguish between seepage and return waters. It was found that the return flow to the South Platte River varies from 2 to 8.5 sec.-ft. per mile for various sections of the river from Kersey to Julesburg, and the average return flow between these two points, a distance of 143 miles, is 5.25 sec.-ft. per mile, or a total of about 750 sec.-ft. The rate of the underflow from the Riverside Reservoir to the river is approximately 100 ft. per day. The reservoirs in the valley are said to contribute about 20 per cent to the return flow. A greater return flow occurs in September than in March, and there is said to be a yearly increase in the seepage return. The returned seepage increases as the river falls and decreases as the river rises. The seepage losses from the Empire and Jackson Lake Inlet canals are approximately 1 sec.-ft. per mile, or 0.4 and 0.58 per cent per mile, respectively. Due to the evaporation, there is said to be a marked daily variation of the flow of the river, especially in District 64. The average efficiency of the large storage reservoirs of the lower South Platte Valley is about 50 per cent. The ratio of returned seepage to irrigated area is approximately 1 sec.-ft. to 275 acres. The ratio of the seepage return in Districts 1 and 64 is about the same as the ratio of the gross duty of water in these two districts. The distribution of water through calibrated rating flumes has been found in some cases to be more than 50 per cent in error where the amount is based upon the calibration made during the first part of the season.

Laws of movement and determination of quantity of ground water, H. KOSCHMIEDER (*Gsndhts. Ingen., 46 (1923), No. 5, pp. 49–52, figs. 2*).—A mathematical analysis of the subject is given, with particular reference to flow into wells.

Irrigation on the Niger and cotton culture, Y. HENRY, F. VUILLET, and H. LAVERGNE (*Les Irrigations au Niger et la Culture du Cotonnier. [Dakar: Gouvt. Gén. Afrique Occident. Franç.] Paris: Émile Larose, 1922, pp. 185, pls. 2, figs. 6*).—This is a report of a preliminary investigation into the soil

fertility and irrigation resources and possibilities in the valleys of the Niger and Senegal Rivers in French West Africa, with particular reference to the establishment of cotton culture. It is estimated that there are some 3,000,000 hectares (7,410,000 acres) of irrigable land adapted to cotton culture. Some of the irrigation works already in operation are described, and some of the studies planned and in operation at a newly established experiment station on the development of cotton culture in the region are outlined. Physical analyses of a large number of samples of the soils of the region are appended.

Artificial rain on cultivated soil, CANZ (*Mitt. Deut. Landw. Gesell., 38 (1923), No. 3, p. 40*).—The results of a 3-year test of the effectiveness of so-called artificial rain applied from a special sprinkling apparatus on several different crops growing in loamy sand soil are presented and briefly discussed. The natural rainfall varied considerably during the three years, being in the last year especially small. The treatment resulted in marked increases in crop yields in all three years.

Researches on the theory of the action of centrifugal pump impellers, O. MIYAGI (*Tôhoku Imp. Univ., Technol. Rpts., 1 (1920), No. 1, pp. 100, figs. 25*).—This is an extensive and very intricate mathematical analysis of this theory.

Cartridge diameter and strength of high explosives, S. P. HOWELL and J. E. CREWSHAW (*Engin. and Contract., Railways, 59 (1923), No. 2, pp. 425–429, figs. 4*).—The results of tests conducted by the U. S. Bureau of Mines on the effect of cartridge diameter on strength and sensitiveness of certain high explosives are reported.

These showed that both the rate of detonation and sensitiveness to explosion by influence increased with the increase in diameter of cartridge. Gelatin dynamites rapidly decreased in sensitiveness to detonation and explosion by influence on aging, while ammonia dynamite was very little affected. The insensitiveness of gelatin dynamites to detonation and explosion by influence on aging proceeded more rapidly the smaller the diameter of cartridge, and also proceeded more rapidly with 60 per cent gelatin dynamite than with 40 per cent gelatin dynamite.

It is concluded that the effect of cartridge diameter is very important in that the more rapid increase in sensitiveness to detonation of the smaller diameter is likely to cause more misfires, while the decrease in sensitiveness to explosion by influence is likely to cause more partial failures from foreign material in the bore hole. An investigation of samples of gelatin dynamites which failed to detonate indicated the great importance of the thorough tamping of gelatin dynamite shots, since the resulting confinement will insure better and more complete detonation. It is generally concluded that both economy and safety in the use of explosives is lost by the use of a ¾ in. diameter of cartridge, and that every effort should be made to use drill holes of sufficient diameter to accommodate cartridges of not less than 1¼ in. diameter, especially when using gelatin dynamites.

Proceedings of a conference on the economics of highway transport called by the Highway and Highway Transport Education Committee held at the University of Maryland, College Park, July 27, 1921, edited by C. J. TILDEN (*Washington: Highway and Highway Transport Ed. Com., 1922, pp. 51*).—The text of the proceedings is given.

Treatise on the conservation and improvement of wood, M. DE KEGHEL (*Paris: J. B. Baillière & Son, 1921. pp. 360, figs. 41*).—This book deals with the theory of the treatment of wood for conservation, with methods and apparatus for impregnation of wood with chemicals, and with wood seasoning.

Further experiments in the air-seasoning of Indian timbers and general recommendations as to seasoning methods, C. V. Sweet (*Indian Forest Rec., 9 (1922), No. 5, pp. VIII+142, pls. 5*).—Further studies conducted on 53 species of Indian timbers in eight provinces are reported (E. S. R., 40, p. 843). The opinion is expressed that, although the most satisfactory solution of many of the timber-seasoning problems in India depends upon kiln seasoning, most of the species dealt with in this study can be seasoned by natural methods with very good results.

It was found that, in general, timber should not be held in the form of logs for seasoning. The amount of splitting by seasoning in the log was considerably greater than by green conversion into lumber, and the surface cracking was not less. Timber in the log was also liable to excessive damage by fungi and insects. Girdling for a period of 18 months reduced appreciably the tendency of the wood to crack after conversion into lumber and during final seasoning, but greatly increased the liability to severe damage by insects.

Immersion in fresh water was found to be the best method of protecting logs awaiting conversion, but did not appear to facilitate the seasoning except in the case of converted pieces of species particularly liable to severe discoloration. Converted timber so treated was discolored and cracked on the surface more than by green conversion directly, followed by stacking on land. Many species after conversion had to be stacked in seasoning sheds so designed as to give protection not only from direct sun and rain, but also from hot, dry winds. The degree of protection required varied with the species and the climatic conditions.

It is stated that the felling of trees which can not be converted into lumber soon after cutting should not be carried on during the hot season or at the beginning of the rains, and refractory woods should be converted into lumber during or as near the end of the rainy season as possible and not during the hot season, unless the lumber can be put into seasoning kilns or otherwise well protected. Soft, nondurable woods should be converted during the dry season and, if possible, stacked vertically to hasten the seasoning to avoid discoloration and decay.

The moisture content of seasoned wood was found to vary with the season of the year and with the climatic conditions of the locality from 4.8 to as high as 15.2 per cent. The rate of seasoning varied with the species, the dimensions of the lumber, and the climatic conditions of the locality.

A chapter on Damage to Timber by Insects, by C. F. C. Beeson, is included.

Durability of fence posts, A. K. Chittenden (*Michigan Sta. Quart. Bul., 5 (1923), No. 3, pp. 137–139*).—Statistical data indicating the average length of life of untreated fence posts made of the various varieties of trees in Michigan are briefly presented and discussed. These indicate that osage orange, black locust, white cedar, catalpa, and red mulberry in their order are the most durable post woods, their lives varying from 30 to 16 years. It is stated that white cedar is probably the most commonly used wood for fence posts in Michigan.

The heating value of corn, W. L. De Baufre (*Jour. Amer. Soc. Agron., 15 (1923), No. 1, pp. 1–6*).—The substance of this contribution from the Nebraska Experiment Station has been previously noted from another source (E. S. R., 47, p. 888).

The most efficient source of power and heat for the dairy, I. Charbonnier (*Tech. Landw., 2 (1921), No. 5, pp. 89–94*).—An analysis is given of the use of heat and power in German dairies, with particular reference to the comparative efficiencies of local steam plant and central station electrical energy. In

this connection, data are presented from a direct comparison of the operation of a particular dairy by steam power plant and by central station electricity. This showed that the steam power plant accomplished about 19 per cent more per unit of fuel used than the central station energy. The conclusion is that steam, especially where waste steam is available, is the logical means for dairy operation.

Power and heat in the dairy industry, I. Charbonnier (*Tech. Landw., 3 (1922), No. 9, pp. 208–212, fig. 1*).—The results of an intensive study of the utilization of power and heat in a German dairy to compare the efficiencies of steam power and central station electrical energy are presented and discussed. Under the present conditions of operation of dairies, central station electrical energy has been found to be considerably more expensive than steam.

Heat study in a dairy of the Dahme district [Germany], G. Fischer and R. Gerdes (*Tech. Landw., 3 (1922), No. 6, pp. 125–129, fig. 1*).—Comparative trials of steam and electric motor power for performing the different operations in a dairy are briefly described. The electrical method was as a whole more expensive than the steam plant method, although less fuel was required.

An experimental survey of gasoline and kerosene carburetion, C. S. Kegerreis and G. A. Young (*Jour. Soc. Automotive Engin., 12 (1923), No. 1, pp. 63–75, figs. 39*).—In a contribution from the engineering experiment station of Purdue University, the results of several investigations on the carburetion of gasoline and kerosene in internal-combustion engines are assembled and considered from various viewpoints, special attention being given to fuel waste. A large amount of graphic data is presented and discussed. The scope of the paper is considered to be too broad for the drawing of general conclusions or for a detailed discussion of any one subject.

The gasoline automobile, G. W. Hobbs and B. G. Elliott (*New York and London: McGraw-Hill Book Co., Inc., 1920, 2. ed., rev. and enl., pp. XX+483, figs. 546*).—This is the second revised edition of this book, by Elliott and E. L. Consoliver, prepared in the extension division of the University of Wisconsin as a number in the Engineering Education Series. It is planned primarily for use in the university extension work in Wisconsin for the instruction of those who drive, repair, or otherwise have to do with motor cars, and is said to be largely the outgrowth of a series of lectures on the subject. It contains chapters on the automobile; automobile engine; automobile power plants; fuels and carbureting systems; engine lubrication and cooling; principles of electricity and magnetism; battery ignition systems; magnetos and magneto ignition; automobile storage battery; starting and lighting systems; automobile chassis and running gear; clutches and transmissions; rear axle and differentials, wheels, rims, and tires; automobile troubles and remedies; and operation and care.

[Machinery and implement studies at the Pusa Research Institute], G. S. Henderson (*Agr. Research Inst., Pusa, Sci. Rpts., 1921–22, pp. 72–76*).—Tabular data are presented and briefly discussed showing the results of the working of steam plowing tackle and tractors.

Tractor traction, E. C. Sauve (*Michigan Sta. Quart. Bul., 5 (1923), No. 3, pp. 135–137, fig. 1*).—The results of a test of an open or latticed tractor wheel on actual plowing are briefly presented. These indicate that the tractor equipped with latticed wheels could negotiate grades and pull loads better than the same tractor equipped with the ordinary types of wheels.

Automatic uncoupling apparatus for tractors, R. Dessaisaix (*Jour. Agr. Prat., n. ser., 38 (1922), No. 50, pp. 500–502, figs. 2*).—An apparatus is described and diagrammatically illustrated which permits the automatic uncoupling of

a tractor from cultivating machinery in cases of sudden overloads or rearing of the tractor at the time of starting. Its purpose is to prevent accidents due to tractor rearing, killing of the tractor motor, and motor breakage due to sudden overload.

The pulverizing rotary cultivator as a substitute for the plow, J. KRAUSE (*Rev. Facult. Agron. y Vet. Buenos Aires, 4 (1922), No. 1, pp. 103–126, fig. 22*).—A description is given of the theory and manner of operation of rotary pulverizers, and brief comparisons are drawn of the work of this type of machine with that of plows.

Turnip thinning and harvesting (*Jour. Min. Agr. [London], 29 (1923), No. 11, pp. 973–979, pls. 2*).—The results of a series of investigations conducted to determine the cost and efficiency of mechanical methods of turnip thinning and harvesting as compared with hand labor are briefly reported. The thinning investigations were confined to turnips and those of harvesting to swedes.

In the thinning investigations it was found that the machines used were considerably cheaper and a little faster than a team of four men. With one exception the yield was greater where thinned by machine, although it is noted that the machine-thinned turnips were on the whole of small size and growing in bunches. The tests demonstrated the possibility of thinning or gapping turnips by mechanical devices at less cost and in less time than by hand labor, and with no loss in the total weight of the crop.

The lifting, topping, and tailing tests with swedes showed that economy in time and money may be effected by machines where a considerable area of roots is to be harvested. One machine drawn by two horses and mounted on four wheels performed work at a speed nearly equal to that of eight men, and at approximately five-eighths of the cost. As an offset to this economy there was the necessary expense for topping the 24 per cent missed by the machine. Another 2-horse machine operating on two rows at once failed to tail the turnips owing mainly to a poorly designed cutting hoe, but it topped them fairly satisfactorily.

The results are taken to indicate that the prospects for lifting, topping, and tailing the root crop are reasonably good. No greater damage was caused to the roots by the machines than by hand labor. It appeared that the greatest possibility of future development lies in the double or multi-row machines.

Theory of the thresher cylinder, W. GORJATSCHKIN (*Tech. Landw., 3 (1922), No. 7, pp. 151–157, figs. 11*).—The mechanics of the thresher cylinder are here reduced to a more or less definite mathematical form on the basis of studies of 11 machines made in a Russian institution before the war.

Horse and power mowing costs compared (*Impl. and Mach. Rev., 48 (1923), No. 574, pp. 1246, 1247*).—Tabular data comparing horse and power mowing costs are presented, indicating that, while the single mower and the tractor are more economical than the horse outfit, it is substantially cheaper to use two-horse mowers and a tractor or a tractor attachment. These results were obtained with a poor hay crop on a very heavy loam soil.

Methods of handling hay in Colorado, G. A. CUMINGS (*Colorado Sta. Bul. 281 (1923), pp. 3–39, figs. 44*).—This bulletin gives a general description of the common and successful methods of curing, stacking, and protecting hay in Colorado.

Alfalfa is the principal hay crop in the State. Curing hay in the swath and windrow is said to be a fast method, producing a good quality of hay and requiring little labor. Curing in the cock is slow and expensive, but produces a superior quality of hay. Curing in the swath is not practiced except with timothy hay or grasses in cool, dry weather.

A comparison of the methods of stacking hay indicates that the overshot stacker is extensively used, is light, fast, and builds stacks with firm, full centers, but requires much labor on the stack. The swinging stacker is similar to the overshot stacker except that labor is reduced on the stack and stacker and there is more liability of building stacks less resistant to water. The combination stacker is best adapted to small crews. It greatly reduces labor on the stack and stacker, approaches any side of the stack, but has a low limit of elevation, is heavy for an average team, and more liable to build stacks less resistant to water. The derrick stacker is cheap, heavy, slow, builds large stacks, and insures good quality hay. The slide stacker is cheap and has a high capacity, but has a limited applicability. Cable stackers, hay sheds, rope stackers, baling from the windrow or cock, hauling directly to alfalfa mills, and blower and hand methods are said to be used only under special conditions. Mechanical power has been introduced successfully into baling, hoisting, and mowing under conditions favorable for each.

Hay losses are comparatively small in the State as a whole, and permanent stack covers are not considered practical except in extreme cases.

Rules for measuring hay are said to give only approximate results and vary greatly on different shaped stacks.

How to build and use a chute in which to hold cattle, C. I. Bray (*Breeder's Gaz., 83 (1923), No. 12, pp. 396, 397, figs. 5*).—Complete directions are given for the construction of a squeeze chute for use in dehorning and branding steers similar to the one which has been in use at the Colorado Experiment Station.

The structure of the house (*Concrete [Detroit], 22 (1923), No. 2, pp. 41–56, figs. 53*).—This is an extensive and profusely illustrated review of concrete house building details, including block, tile, and monolithic systems, with double and single walls.

Heat transmission of commercial wall board, G. A. Cumings (*Colorado Sta. Bul. 282 (1923), pp. 8, figs. 5*).—The results of an investigation to determine approximately the rates at which heat is transmitted through the leading makes of commercial wall boards are presented.

The results were calculated from the formula

$$U=\frac{3.412\ W}{A\ (t-T)\ H}.$$

In this formula W equals watts supplied to the heating element; t, inside air temperature; T, outside air temperature or room temperature; A, heat transmitting areas in square feet; H, time in hours; U, total heat transmission, British thermal units per hour, per square foot, per degree Fahrenheit difference in temperature, per actual thickness; and 3.412, the factor to convert watts into British thermal units per hour.

The average coefficient of heat transmission varied from 0.73 for beaver board to 1.01 for sheet rock wall board. Four other types of wall board had coefficients varying from 0.78 to 0.81.

It is stated that as an insulator of heat this material is a little inferior to common lath and plaster 0.5 in. thick. It is said to be superior to wood in many cases of light construction, since it is light and uniform and leaves no cracks. It is not as durable as lath and plaster.

The apparatus used is described.

The plan of construction of pullet house, G. R. Shoup (*Western Washington Bimo. Bul., 10 (1923), No. 6, pp. 130, 131*).—A list of materials for the construction of a pullet house is given briefly.

RURAL ECONOMICS AND SOCIOLOGY.

Cost of milk production on 48 Wisconsin farms, S. W. MENDUM (*U. S. Dept. Agr. Bul. 1144 (1923), pp. 23, figs. 3*).—The purpose of this study of farms in the eastern parts of Sheboygan and Columbia Counties, west and south of Milwaukee in the Milwaukee milk district, in Ozaukee and adjacent counties north of Milwaukee, in the southeastern corner of Marathon County, and in others which are grouped according to similarity in the more important factors of location, markets, feeds, and herd management was to note the management of herds under ordinary farm conditions and to measure the more important cost factors.

The farms ranged in size from 17 to 240 acres, the herds from 3 cows and 1 heifer to 28.7 cows and accompanying stock cattle. The herds ranged in production from 13,000 lbs. per cow down to 2,830 lbs. as an average for the year.

Data are tabulated and analyzed which show feed requirements and consumption, labor applied to milk production, incidentals and overhead, and production and prices.

The cost of producing milk in 1920 on the 48 farms was $3.30 per 100 lbs., with a modified allowance for depreciation, or $3.57 per 100 lbs. with depreciation as observed. An allowance of 19 cts. per 100 lbs. is included for interest.

Cost of 100 lbs. of milk and average value of milk produced on 48 Wisconsin dairy farms in 1920.

Item.	Group A.	Group B.	Group C.	Group D.	Group E.	All farms.
Number of farms	12	8	11	8	9	48
Feed	$1.80	$2.07	$2.19	$2.32	$1.82	$2.02
Manure—credit	.24	.32	.32	.34	.28	.29
Net cost of feed	1.56	1.75	1.87	1.98	1.54	1.73
Labor at 40 cts. per hour	.68	.84	1.00	1.39	1.21	.94
Hauling milk sold	.08	.14	.07	.02	.18	.09
Cow cost	.24	.31	.30	.18	.24	.27
Building use	.12	.20	.28	.25	.18	.20
Equipment and general	.05	.05	.07	.11	.11	.07
Total cost	2.73	3.29	3.59	3.93	3.46	3.30
Claimed depreciation	.02	1.00	.45	.52	.29	.48
Average price per 100 lbs.	2.33	2.38	3.15	3.15	2.67	2.65

Some of the supplementary sources of income are noted briefly.

Preliminary report: Business analysis of 181 general crop, 11 dairy, and 10 fruit farms, Twin Falls County, Idaho, 1921, B. HUNTER (*Idaho Sta. Bul. 132 (1923), pp. 3–19*).—Continuing previous work (E. S. R., 45, p. 188; 47, p. 593), this report presents the business analysis of farms studied for the crop year 1921, a comparison of the financial returns of the general cash crop farms for the three years 1919 to 1921, and the average crop yields secured and prices received for crops during the 3-year period.

The 181 general crop farms were arranged in groups according to size of farm. The average return to capital for the group of farms of 40 acres and less was 0.8 per cent, for those of 41 to 80 acres 1.6 per cent, and for those over 80 acres 2 per cent. The average value of land was $289, $261, and $250 per acre, respectively, in the size groups. If all land were to be valued uniformly at $250 per acre, the average return per capital for the respective groups would be 1, 1.7, and 2 per cent.

Data are tabulated and commented upon as setting forth the relation of the size of farm to the efficient use of labor and machinery, the relation of crop yield to return on capital, the relation of size of farm to standard of family

living, and receipts and expenses. Crops, live stock, the variations in return to capital and labor income, and the farm business according to tenure are similarly presented.

In a summary of the business of these, together with 10 fruit and 11 dairy farms, it appears that the average value of real estate was $334 per acre for the fruit farms, $269 for the dairy farms, and $263 for the general crop farms. The fruit farms, which were in most cases apple farms, returned an average of 10.5 per cent, the dairy farms 5.9 per cent, and the general crop farms 1.6 per cent on the farm capital.

Application of the law of diminishing returns to some fertilizer and feed data, W. J. SPILLMAN (*Jour. Farm Econ., 5 (1923), No. 1, pp. 36–52, figs. 5*).—Curves are drawn in illustration of the effect of increasing amounts of fertilizer on the yields of cotton and of potash on cabbage, also of decreasing returns from irrigation water and from feed on hogs and cattle.

Substituting in the formula for the sum of a decreasing geometric series the author obtains $y=A(1-R^x)$. Here y represents the increase in yield due to x units of fertilizer, or the increase in weight from the consumption of x units of feed, and A represents the total increase in yield obtainable from the use of a given fertilizer, or the total gain an animal can make on a given feed. Using M to represent the maximum yield obtainable with any quantity of a given fertilizer on a given crop, Y for the yield corresponding to x units of fertilizer, and y_o the yield without fertilizer, then $Y=M-(M-y_o)R^x$. Profit per acre is expressed by the formula $p=VY-Kx-C$. Again

$$x=\frac{\log L+\log K-\log V}{\log R}.$$

The value of x found in this equation is the number of units of fertilizer that gives the greatest profit per acre from the crop. The equation $P=0.10Y-3x-30$ is found for the profit on one acre, and $P=n(VY-Kx-C)$ is a mathematical expression for the law of diminishing returns on capital. Survey data applied in these and some of the other equations worked out are illustrated graphically.

It is concluded that the law of diminishing returns has one form when the amount of land available is limited and another when capital is the limiting factor. The law of diminishing net returns is, furthermore, to be distinguished from that of diminishing increment in the yield of a crop, weight of an animal, etc.

Investigation with reference to agricultural business management, O. H. LARSEN and I. DOKKEN (*Landøkonom. Driftsbur. [Denmark], Undersøg. Landbr. Driftsforh., No. 5 (1922), pp. 187*).—This is the fifth of a series of regular annual reports, and is based on data obtained from about 450 local accounting circles selected and reviewed by advisers of the accounting societies in Denmark. General agricultural conditions that prevailed during the crop year 1920–21 are described. Data are classified and tabulated to show the area devoted to the principal crops, the capital invested in agricultural enterprises, gross earnings, expenses of carrying on the business, net returns, the influence of size of holdings upon returns from crops and live stock, and household expenses.

Controlling agricultural output, H. A. WALLACE (*Jour. Farm. Econ., 5 (1923), No. 1, pp. 16–27*).—The author urges a broad educational campaign for controlling crop acreage. A discussion of this paper is contributed by E. Mead.

Results with special crops in the Piedmont section in 1922, E. C. Westbrook (*Ga. Agr. Col. Circ. 89 (1923), pp. [4]*).—A survey was made in December to determine what returns had been realized from special crops in this section of Georgia in 1922. Brief reports are given here with respect to peanuts, soy beans, the mung bean, alfalfa, broom corn, sunflowers, tobacco, and truck crops.

Agriculture in cut-over redwood lands, W. T. Clarke (*California Sta. Bul. 350 (1922), pp. 165–186, figs. 9*).—The soils, climatic conditions and possibility of irrigation, clearing, possible cropping systems, pests, transportation and marketing facilities, and social life of cut-over redwood forest areas in California are described here. The isolation of farms and the great difficulties of transportation are emphasized. In view of the increasingly insistent demands of our civilization for lumber, it is held that the most natural and advantageous use to which these redwood forests can be put is the continued production of timber. Attempts are being made, however, to use the lands for agricultural and other purposes, and this study is offered in the hope that it may contribute to a fuller knowledge of the conditions to be met.

Manual of rural appraisement as applied in California, J. J. Fox (*San Francisco: Pacific Rural Press, 1923, pp. XII+13–154, figs. 5*).—This is designed as a handbook for the banker, realtor, and investor. The productivity and endurance of land, the extent of its adaptability to various crops, and its convenience to good markets and cheap transportation are deemed the fundamental bases of land valuation. Methods and exceptional problems of the appraisal of agricultural land in California are discussed. A detailed treatment is given of the determination of the value of range, alfalfa, and dairy lands; orchard lands; vineyards; citrus groves; and truck lands and rice lands. A brief discussion is given of agricultural lands as loan security. Appendixes contain tables of prices of land and agricultural products in California through a period of years, also a list of the principal farmers' marketing organizations in California in 1922 and the State acreage of fruit, nuts, and vines as of 1921.

The use of crop reports by farmers, L. M. Estabrook (*Jour. Farm Econ., 5 (1923), No. 1, pp. 28–35*).—It is evident from the answers to questionnaires sent out to voluntary county crop reporters that Government crop reports serve three purposes to the individual farmer; first, that of keeping him informed as to the condition and crop prospects in his own State and in other States; second, helping him in judging the probable relative supply of surplus crops and whether it will pay him to sell his surpluses promptly or hold them; and, third, furnishing a basis for judging the probable advantage of making any change in his established crop system.

Weather, Crops, and Markets (*U. S. Dept. Agr., Weather, Crops, and Markets, 3 (1923), Nos. 9, pp. 185–200, figs. 2; 10, pp. 201–216, figs. 2; 11, pp. 217–256, figs. 4; 12, pp. 257–280, figs. 6; 13, pp. 281–304, figs. 5*).—Temperature and precipitation charts are presented for the weeks ended February 27 and March 6, 13, 20, and 27, 1923, with weekly reviews of weather conditions. There appear also the usual tabulated weekly and monthly reports and special articles pertaining to receipts and prices of important classes of crops and live stock and the position in the market of specific commodities.

The form of this publication was changed beginning with No. 10, and the contents rearranged in order to include more comparative data. The foreign crops and markets report in No. 12 consists of a special article on the cattle crisis in Argentina, illustrated with graphs of index numbers of beef and cattle prices at Buenos Aires and Chicago and London, 1902–1922. The March monthly fluid milk and cold storage reports are given in the same number. Short special articles on the northwestern apple season, the jobbing markets of

Philadelphia, and cooperative shipping-point inspection appear in No. 11, as well as the March crop report and crop news from foreign countries. With the usual tables showing crop acreage and condition and farm values there are included tabulated reports on taxes on farm lands, 1913–14 to 1921–22, by States; farm stocks of grains and shipments out of the counties where grown, value of plow lands by States, 1920 to 1923; and other items. No 13 contains a special article on potato production.

Preliminary study of the methods and means of handling fresh produce in Rhode Island, H. B. Hall (*Rhode Island Sta. Bul. 192 (1923), pp. 4–28, figs. 2*).—This sets forth the geographical position of Providence, R. I., and its railroad and other transportation facilities and terminals for the handling of perishable foods. The general problem of distribution is presented from the points of view of mobilizing, financing, and handling fresh produce.

Suggested remedies for the congestion at Providence are the extension of the Grand Trunk Railroad from the north, an increase in the boat service to Providence, the improvement of automobile routes between Providence and neighboring railroad cities, and an increase in the native food supply. It is recommended that the local farmers increase their production of clean milk and specialized crops for this market.

The regulation of grain handling in France in the eighteenth century, C. Musart (*La Réglementation du Commerce des Grains en France au XVIII^e Siècle. Paris: Ed. Champion, 1921, pp. 266*).—This discussion of the policies of various French ministers of finance in the eighteenth century with regard to Government control of trade in grain and foodstuffs is based upon the Traité de la Police, by N. Delamare. This is an exhaustive compilation of police regulations, with comment on the economic principles underlying the attitude of the time with regard to police protection. One volume deals particularly with the supply of foodstuffs, prices, and the prevention of famine. It was published between 1705 and 1738 and embodies the traditional attitude of the ruling classes, which was bitterly opposed by the Physiocrats.

Corn prices and the corn laws, 1815–1846, C. R. Fay (*Econ. Jour., 31 (1921), No. 121, pp. 17–27*).—Causes of the rise in the price of grains in England between 1815 and 1846 are analyzed historically in the light of the influence of the corn laws. The question is raised as to whether, if repeal had come in 1828 or in 1838, the big expansion of imports which followed after 1846 would have followed after either of these earlier dates. The judgment is that corn law repeal in 1828 would have been an act of faith, hazardous in the light of precedent, but justified by events. Prices would have been considerably steadier at a slightly lower level. As it was, obstructions were removed just when their retention would have caused them for the first time in corn law history to raise materially the price of English bread. The course of prices between 1846 and 1855 is cited in commenting on this judgment.

The farmers' influence over prices, B. H. Hibbard (*Jour. Farm Econ., 5 (1923), No. 1, pp. 1–15*).—The author here describes the shifting of margins, costs, and incomes in recent years, in which the farmer has been the loser. Certain ways of influencing prices, such as economies in methods of bridging the gap between producer and consumer, changing the price level, changing the demand for the goods in question, eliminating some portion of the competition among producers as by a tariff, establishing a private monopoly, and lowering the cost of production, are discussed and rejected as inadequate. The program of relief that is outlined includes a decrease in production and an enlargement of the market, particularly by the rehabilitation of the buying power of Europe.

Prices of farm products in New York, G. F. WARREN (*New York Cornell Sta. Bul. 416 (1923), pp. 63, figs. 16*).—This is a discussion of certain price tendencies that are considered helpful in forecasting prices, including wholesale prices in the United States for 132 years and monthly prices before, during, and following the Civil War and the World War; factors affecting prices, such as the quantity of money, long-time changes in ease of production or in demand, the season of the year, cycles of over and under production, the weather and other accidental causes, and cycles of high and low demand; also freight rates and prices; relation of farm prices to wholesale prices; and purchasing power.

It is held that prices will be more erratic than formerly, and that more unforeseen changes will occur. The up and down swings will be much more violent than before the war, but will decease in time. The long-time tendency of prices will probably be downward, and they are likely to reach the pre-war level in from 10 to 15 years. If the general tendency is downward, the cycles of high and low will swing about a declining base. Prices of each individual commodity will continue to swing about the general price level. Wages may be expected to lag behind prices, and serious periods of unemployment may be expected at times. The prices of industrial stocks or interest rates may be expected to give warning of probable changes in the demand for farm products.

Prices paid to New York State farmers are tabulated for each month, 1910 to 1922, inclusive, and yearly averages are calculated. Index numbers of the same are also tabulated, and prices paid to producers of farm products in the United States are summarized from a bulletin previously noted (E. S. R., 46, p. 192).

Some conclusions with regard to the fall of live stock prices in Czechoslovakia, U. FIESS (*Nachr. Deut. Landw. Gesell. Österr., n. ser., 5 (1921), No. 16, pp. 151–154*).—It is pointed out here that the currency of the country has decreased in value thirteenfold since before the war and also that, owing to the curtailment of working hours and high wages, labor costs in general and especially to farmers are 50 per cent higher than formerly. Computing a list of prices for live stock and live-stock products, machinery, and the things the farmer buys as they would be taking these circumstances into consideration, the author attempts to show that what the farmer sells is too low and what he buys too high in price and by how much.

Development of agriculture in Georgia from 1850 to 1920, R. M. HARPER (*Ga. Hist. Quart., 6 (1922), Nos. 1, pp. 3–27, fig. 1; 2, pp. 97–121, fig. 1; 3, pp. 211–232, fig. 1; 4, pp. 323–354, figs. 4; also reprint. University, Ala.: Author, [1923], pp. [104]*).—Four articles are published here, the first two dealing with the development of agriculture in upper and lower Georgia, respectively, from 1850 to 1880, and the last two with the corresponding development from 1890 to 1920. A summary for the whole State, 1850 to 1920, is also given. The salient geological, climatic, and population features of each region and the prevailing conditions in each decade are sketched.

About 1880 the influence of commercial fertilizers began to be felt, and the improved land curves on the graphs given show an upward turn in regions which before that time were regarded as almost unfit for farming. One of the graphs illustrates the percentage of negro farmers by regions at different times. The proportions increased steadily from the end of the Civil War up to 1900, except in the coast strip where there was a considerable number of negro farmers even in 1870. A graph is also given illustrating the changes in the standard of living of the average white farmer in each region. Census reports for the acreages of different crops and numbers of farm animals are reviewed in detail.

The populist movement in Georgia, A. M. ARNETT (*Columbia Univ. Studies Hist., Econ., and Pub. Law, 104 (1922), No. 1, pp. 239, pl. 1, figs. 5*).—The unique political situation in the South immediately after the Civil War is held to contribute particular interest to the populist movement as it developed in that section. The careers, views, and influences exerted by a number of political leaders who established the so-called Bourbon Democracy there are set forth. Economic developments of the period between 1870 to 1890 and their effect on agriculture, giving rise to discontent and unrest with falling prices and credit difficulties, are described. The populist movement with the activity of the Farmers' Alliance is called primarily agrarian, and the participation of the latter in politics is described in detail. An extensive bibliography is given.

The potentiality of agriculture in Portugal, A. L. GUERRA DE SEABRA (*A Potencialidade Agricola de Portugal. Inaug. Diss., Inst. Super. Agron., Lisbon, 1920, pp. 120, pl. 1*).—This describes briefly the climatic and soil conditions of Portugal and sets forth statistically the production of principal crops in former years. The author urges the extension of irrigation and discusses some other means of increasing agricultural production.

The agricultural situation in Austria, L. C. MICHAEL (*U. S. Dept. Agr., Bur. Agr. Econ., Foreign Sect. Rpt. 28 (1923), pp. 37, pls. 2*).—Statistics of pre-war agricultural production in the Austrian Kingdom are brought together, and the program of the Austrian Republic, including Burgenland, for increasing food production and the animal industry to the maximum is presented statistically.

[Interim report and minutes from the select committee upon the conditions and prospects of the agricultural industry and methods of improving the same], J. H. CARRUTHERS ET AL. (*N. S. Wales Leg. Council, Interim Rpt. Select Com. Conditions and Prospects Agr. Industry [etc.], 6 (1921), pp. XXVI+260–668, pls. 9, fig. 1; Min. Proc., pp. VIII+661–720*).—The sixth interim report with minutes of proceedings and minutes of evidence, as well as minutes of evidence taken since this report was tabled, are published here, continuing information previously noted (E. S. R., 46, p. 694). Tabulations are presented in appendixes to the report, and graphs are given setting forth the population, acres under cultivation, the production of wool and of live stock, and rural holdings in New South Wales.

Final report from the select committee on the conditions and prospects of the agricultural industry and methods of improving the same, J. H. CARRUTHERS ET AL. (*N. S. Wales Leg. Council, Final Rpt. Select Com. Conditions and Prospects Agr. Industry [etc.], (1921), pp. [3]+228, pls. 55, figs. 12*).—This final report is submitted in ten parts, dealing, respectively, with the drift to the city; conditions of the industry; the wheat growing industry; the dairying industry; the fruit growing industry; dry farming, irrigation, and special crops; mixed farming; agricultural education and research; the hazards of production; and rural finance and miscellaneous projects. It is the summary of an exhaustive investigation of the agriculture of New South Wales, interim reports and minutes of evidence for which are embodied in the above.

The report of the Agricultural Organization Society for the year ended March 31, 1922 (*Agr. Organ. Soc. [London] Rpt., 1922, pp. 68*).—This continues the series of annual reports previously noted (E. S. R., 47, p. 394).

An introduction to cooperation in India, C. F. STRICKLAND (*London and Bombay: Humphrey Milford, Oxford Univ. Press, 1922, pp. [7]+75*).—The author discusses underlying principles and draws lessons for India from the systems of cooperative societies that have developed in England and Italy. The credit society, societies of consumption and supply, and production and sale, together with other forms of cooperation in India, are described in detail.

Cooperative agricultural mills, G. MARTINET, A. MAYOR, ET AL. (*Les Moulins Coopératifs Agricoles. Lausanne: Union Suisse Moulins Agr., 1922, pp. 29+1*).—A number of short, signed articles pertaining to Swiss cooperative flour mills, their history and organization, the mill at Yverdon, the kinds of wheat best adapted to milling, and the Swiss confederation of agricultural mills are presented in these papers.

A church and community survey of Salem County, N. J. (*New York: George H. Doran Co., 1922, pp. X+11–92, figs. 25*).—This report belongs to the series previously noted (E. S. R., 48, p. 493). In part 1 the economic life of the county is discussed under the general heads of agriculture, industry, and transportation, and it is characterized as prosperous and progressive. Part 2 sets forth the situation as regards religious life and institutions.

At present in the town and country area of Salem County there are 41 active and organized Protestant churches, 30 for white people and 11 for negroes, who also have one separate colored Sunday school. There are 5 active Jewish synagogues, 2 Roman Catholic churches, 6 separate white Sunday schools, and 3 preaching points of white Protestant churches.

The data with regard to equipment and finance, ministers, membership, and organization and program deal with the white Protestant churches. Chapters are also given to negro church life and non-Protestant churches.

This county is found to be above the average, and the extent and depth of missionary interest is said to be encouraging.

A church and community survey of Pend Oreille County, Wash. (*New York: George H. Doran Co., 1922, pp. XII+11–51, figs. 23*).—This pamphlet is one of the series noted above, representing the results of a church survey begun under the auspices of the Interchurch World Movement and completed by the committee on social and religious surveys. A description is given of the frontier economic conditions and social characteristics of this county in northern Washington. In regard to the religious situation, it is brought out that there are 7 organized and active Protestant churches, 3 separate Protestant Sunday schools, 2 white Roman Catholic churches, and one Roman Catholic Indian Mission. The Protestants through comity arrangements have divided the missionary field. The total seating capacity of the church buildings is 1,375, with an average of 275. A detailed report is made on the finances, membership, ministers, organization, and programs of these churches. The problem of winning and holding this county for the church is held to be one of procuring aggressive leaders for churches with constantly changing congregations and corps of workers and of sending missionary workers to reach the lumber camps and remote farms.

Some great commodities, E. M. MILLER ET AL. (*Garden City, N. Y.: Doubleday, Page & Co., 1922, pp. 287, figs. 2*).—Studies are presented of 10 commodities, including with others cotton, lumber, rubber, silk, sugar, wheat, and wool, which figure conspicuously in the economic progress of the United States and in the international trade of the world. Compilations of statistics of production and trade have been made from census and other Government reports and recognized trade sources.

The census of live stock of 1921 (*Dept. Landb., Nijv. en Handel [Netherlands], Verslag. en Meded. Dir. Landb., No. 1 (1922), pp. 1–36*).—Tabulation by classes of live stock and by provinces is given in these pages on the basis of the enumeration of live stock in the Netherlands in 1921, carried on for the first time since a census taken in 1910. Comparisons are made between the returns of the two.

AGRICULTURAL EDUCATION.

The education of the rural people, K. L. Butterfield (*World Agr., 3 (1923), No. 1, pp. 212–215, fig. 1; also in Jour. Rural Ed., 2 (1922–23), No. 4–5, pp. 166–174*).—This was the president's opening address at the Fifth Conference of the American Country Life Association at Columbia University, November 9–11, 1922. Four considerations deemed essential to the effectiveness of education for rural youth are discussed as genuine equality of opportunity, the necessity of providing a system of training for farming and farm home making, inspiring the pursuit of culture, and giving a religious interpretation to rural work and life. A short analysis is given of three main channels of popular adult rural education.

How to provide the children of agriculturists with a professional agricultural education, H. Miserez (*Comment Mettre Tous les Enfants des Agriculteurs à Même de Recevoir un Enseignement Agricole Professionnel. Brussels: [Min. Agr. et Trav. Pub.], 1922, pp. 15*).—About 46,875 boys and girls are said to be leaving the rural schools of Belgium yearly at 14 years of age. The necessity of providing them with continuation courses in agriculture is emphasized. An outline of a system of professional continuation schools is given, together with the plan of the Government for financing such public education.

The West-Indian College of Tropical Agriculture, J. B. Farmer (*Indian Sci. Agr., 4 (1923), No. 3, pp. 103–105*).—The foundation of this institution and its courses and facilities for study are briefly described.

Education [in New Zealand], M. Fraser (*New Zeal. Statis., 4 (1919), pp. 13–16; 4 (1920), pp. 11–14*).—Some statistics of the attendance in agricultural and home-making courses and of receipts and expenditures are presented here.

Rooms and equipment for the teaching of vocational agriculture in secondary schools, W. F. Stewart (*Fed. Bd. Vocat. Ed. Bul. 81 (1923), pp. V+30, pl. 1, figs. 8*).—This study is limited in scope to vocational departments in secondary schools, of which there were 1,937 in the United States in 1921–22. Specific suggestions are formulated as to features of construction, location and equipment of rooms, farm shop equipment, apparatus, and helpful collections of bulletins. Floor plans reproduced for illustration of possible room arrangements are from Minnesota, Ohio, and North Carolina.

Improving the school building facilities of one- and two-teacher districts through measurement, J. E. Butterworth (*N. Y. Agr. Col. (Cornell) Ext. Bul. 52 (1922), pp. 217–233, fig. 1*).—There are presented here an analysis of the more important features of a good rural school plant; a method of recording, specifically and uniformly, facts regarding it; a set of standards as the basis for an interpretation of these facts; and a method by which the conditions in any particular building may be so presented as to convey a definite idea of its needs.

A score card for one- and two-teacher school buildings, J. E. Butterworth (*Jour. Rural Ed., 2 (1922), No. 1, pp. 9–20, figs. 4*).—This sets forth the way in which the score card for rural school buildings (noted above) was worked out and the method of using it. Thirty-eight district superintendents were trained in the use of this score card in connection with the New York rural school survey, and the study was made of the degree of uniformity in scoring exhibited by them. Some of the data secured through this score card in the New York survey are briefly reviewed.

Circular letters in rural school supervision, A. Knobel (*Jour. Rural Ed., 2 (1922–23), No. 4–5, pp. 185–194*).—Inspirational routine and follow-up letters,

as well as outlines for use with the course of study, are described here. In the editor's note there are presented a number of samples of these types of letters.

Rural teacher training in Wisconsin, A. REYNOLDS (*Jour. Rural Ed., 2 (1922–23), No. 4–5, pp. 174–185*).—A portion of the biennial report of the State superintendent of schools for Wisconsin is given here which presents the findings of a questionnaire submitted to teacher-training agencies for information with regard to literary societies, opportunities for rural practice teaching, extension activities, school visitation, tests and measurements, health work, and rural school progress.

The relation of home economics to the rest of the rural high school program, G. A. WORKS (*Jour. Home Econ., 15 (1923), No. 1, pp. 1–7*).—It is held that at the present time instruction in home economics does not have the time emphasis in the high-school program that its importance warrants. It is suggested that the remedy is to be found partly in the professional preparation of high-school administrators for the consideration of vocational education. There is some criticism of the lack of correlation between the high-school teaching and the pupils' responsibilities in connection with home work.

Junior extension work as developed through the public schools, W. J. WRIGHT (*Jour. Rural Ed., 2 (1922–23), No. 4–5, pp. 207–212*).—Junior extension work is here held to have for its purpose the offering of an opportunity for instruction along some line of agricultural or home-making activity by demonstrations, publications, or otherwise, but always supplemented by carefully supervised home work, the project. This work as carried on in New York State is outlined specifically.

Club work as organized independent of the public school, J. ARNQUIST (*Jour. Rural Ed., 2 (1922–23), No. 4–5, pp. 212–218*).—This is a statement of the way in which boys' and girls' club work is conducted in Iowa in order to reach the young people who are no longer in school. Meetings are held in the homes of the community, and leadership is vested in men and women who remain in the county 12 months of the year. The advantages and disadvantages of organization according to both home and school groups are set forth.

Half-acre corn, D. R. DODD (*W. Va. Agr. Col. Ext. Project Circ. (1922), pp. 32, figs. 21*).—Suggestions are made to club boys who select the half-acre corn project. They cover the selection of land, care of equipment, selection of seed, planting, and cultivating the crop, as well as preparing a 10-ear exhibit.

Recreation and play for junior rural democracy, O. J. KERN (*Jour. Rural Ed., 2 (1922), No. 1, pp. 1–8*).—A number of reference books and bulletins are listed as helpful in organizing play for one-room rural schools. Equipment for larger schools and organization for community festivals are also discussed.

Suggestions for community and county fairs, B. HARPER ([*Rock Hill, S. C.*]: *Winthrop Col., Ext.* [*Div.*], [*1922*], *pp. 21, figs. 7*).—Suggestions are compiled for the assistance of home demonstration agents in arranging fairs and awarding prizes.

Practical courses in cattle raising organized by the Association of Cattlemen (*Bol. Agr. Téc. y Econ., 15 (1923), No. 169, pp. 91–97*).—The rules governing them and the program of courses offered in Spain, including instruction in animal husbandry, dairying, poultry, and beekeeping, are set forth here.

Agriculture in the Tropics, J. C. WILLIS (*Cambridge, Eng.: Univ. Press, 1922, 3. ed., rev., pp. XVI+223, pls. 24*).—This is a third edition of the volume previously noted (E. S. R., 32, p. 227).

Introductory botany, R. E. TORREY (*Amherst: Mass. Agr. Col., Dept. Bot., 1922, pp. XI+78*).—An outline is presented of a course in botany, beginning with a study of a typical seed plant, then studying the seed and its germination, and afterwards the root, stem, leaf, flower, and fruit in sequence.

Modern equipment for domestic science work (*School and Col. Cafeteria, 3 (1923), No. 4, p. 10, figs. 3*).—Illustrations show equipment installed in three schools.

MISCELLANEOUS.

Forty-first Annual Report of New York State Station, 1922, R. W. THATCHER (*New York State Sta. Rpt. 1922, pp. 51*).—This contains the organization list, a review of the work and publications of the station, and financial statements for the fiscal period from July 1, 1921, to November 30, 1922. The experimental work reported is for the most part abstracted elsewhere in this issue.

Proposed program of development (*New York State Sta. Circ. 60 (1922), pp. 7*).—Under date of July 1, 1922, a general program of development of the facilities for research work at the station for the next decade is here presented.

List of projects under investigation (*New York State Sta. Circ. 61 (1922), pp. 4*).—The station projects under investigation July 1, 1922, are listed.

Available bulletins (*New York State Sta. Circ. 62 (1922), pp. 4*).—The bulletins, popular bulletins, and technical bulletins of the station available for distribution October 1, 1922, are listed.

Periodicals available for reference (*New York State Sta. Circ. 59 (1922), pp. 18*).—The periodicals available for reference in the station library are listed.

1922 experiments on control of borers and leaf curl of peaches, P. J. PARROTT, F. C. STEWART, and H. GLASGOW (*New York State Sta. Circ. 64 (1922), pp. 7*).—This consists of two articles, Paradichlorobenzene for Control of Peach Borer and Dusting and Spraying for Peach Leaf Curl, noted on pages 53 and 49 of this issue.

Quarterly Bulletin of the Michigan Experiment Station, edited by R. S. SHAW and E. B. HILL (*Michigan Sta. Quart. Bul., 5 (1923), No. 3, pp. 93–153, figs. 21*).—In addition to articles abstracted elsewhere in this issue, this number contains the following: College Winnings at 1922 International, by W. E. J. Edwards; 1922 International Grain and Hay Show, by H. C. Rather; Cooperative Overstate Grain Variety Tests, by D. F. Rainey; County Alfalfa Campaigns in Michigan, by G. W. Putnam; Inoculation of Legumes, by R. M. Snyder; Beans and Beets for 1923, by J. F. Cox; Three Good Corn Varieties, by J. R. Duncan; Quality Seed for Economical Potato Production, by H. C. Moore; and Plant Early Potatoes at Proper Time, by C. E. Cormany.

Bimonthly Bulletin of the Western Washington Station (*Western Washington Sta. Bimo. Bul., 10 (1923), No. 6, pp. 113–136, fig. 1*).—In addition to articles abstracted elsewhere in this issue, this number contains brief articles entitled Beginning with Bees, by B. A. Slocum; Annual and Perennial Flowers for the Home, by A. M. Doerner; Fertilizers for Lawn and Garden Use, by M. E. McCollam; Spring and Summer Spraying Programs for Western Washington, by A. Frank; and Sterility in Dairy Cattle, by W. T. Johnson.

NOTES.

Arkansas University and Station.—Dr. V. H. Young, professor of botany and plant pathology in the University of Idaho, has been appointed to succeed the late Dr. J. A. Elliott as professor of plant pathology in the university and plant pathologist in the station, effective July 1.

California University and Station.—Following the resignation July 1 of Dean T. F. Hunt, noted editorially in this issue, Dr. H. J. Webber, professor of subtropical horticulture and director of the Citrus Experiment Station, has been designated acting dean of the college of agriculture. Dr. William H. Chandler, professor of pomology, pomologist, and vice director of research at the New York State College of Agriculture, Cornell University, has become professor of pomology, effective July 1, with headquarters at Berkeley. Dr. W. A. Lippincott, head of the department of poultry husbandry at the Kansas College, has been appointed professor of poultry husbandry, effective August 1, with headquarters at Davis. D. R. Hoagland, associate professor of plant nutrition, and W. Metcalf, associate professor of forestry, have been given a year's sabbatical leave of absence for foreign travel and study.

Connecticut College and Stations.—W. L. Slate, jr., professor of agronomy in the college and vice director of the stations, has been appointed director vice Dr. E. H. Jenkins, whose retirement is noted editorially in this issue. Dr. Thomas B. Osborne of the State Station has been appointed research associate in biochemistry at Yale University with professorial rank.

Delaware Station.—The resignations are noted of J. H. Clark, assistant horticulturist, on August 1 to accept a position as instructor in horticulture in Rutgers College, and G. V. C. Houghland, assistant agronomist, to pursue further study in the University of Delaware.

Georgia College.—A 2-story animal husbandry building has recently been completed.

Iowa College and Station.—A recent issue of *Iowa Agriculturist* announces that Dr. E. G. Nourse, head of the department of agricultural economics, has accepted a position as dean of the Institute of Economics at Washington, D. C. C. L. Benner, assistant professor of agricultural economics, has also accepted an appointment with the same institution.

Kansas College and Station.—The Agricultural Association has inaugurated the custom of presenting association medals to the members of teams representing the college in intercollegiate judging tests.

Appointments have recently been made of C. O. Swanson as head of the department of milling industry, L. F. Payne as head of the department of poultry husbandry, R. J. Silkett as assistant in cooperative experiments, I. K. Landon as assistant professor of agronomy, J. A. Hodges as instructor in agricultural economics, and Bertha Snyder as assistant in genetics.

Kentucky Station.—The resignations are noted of R. E. Stephenson, field agent in agronomy (extension); Virginia Croft, instructor in home economics; Margaret Coffin, assistant professor in home economics; Margaret Whittemore, State agent, home demonstration work (extension); and G. L. Hoeft, assistant in veterinary science.

Louisiana Stations.—The sugar station at Audubon Park has been ordered transferred to the new site of the college of agriculture near Baton Rouge. This station has been in operation since 1885, and since 1889 has occupied its present location in a portion of Audubon Park. Notification has been served on the station authorities that this land is now needed for park purposes, the date of evacuation being set at March, 1924.

Michigan College and Station.—The division of veterinary science has been reorganized to include the department of bacteriology and physiology, and with Dr. Ward Giltner as dean.

Montana College and Station.—W. F. Schoppe, head of the department of poultry husbandry, resigned May 1 to engage in farming in Maine.

Nebraska University and Station.—J. A. Luithly, assistant professor of dairy husbandry and assistant dairy husbandman, resigned June 1, and Charles T. Cornman, specialist in poultry husbandry, August 1.

Nevada University.—Frank Williams of Goodsprings and Mrs. Sophie E. Williams of Hot Creek have succeeded B. F. Curler and Miles F. North on the board of regents.

New Hampshire University and Station.—Under an act passed by the legislature at its recent session, the college has been rechristened the University of New Hampshire. It is not expected that the change in the name will involve any material change of policy in the management of the institution.

The total appropriation for the university is slightly larger than for the preceding biennium, amounting to $670,000 for the ensuing two years. The funds for extension work have been slightly increased, while those for the station remain the same as for the past year. No new buildings were authorized.

Rutgers College.—The honorary degree of D. Sc. was conferred on Dean and Director J. G. Lipman by the college June 12. E. J. Perry, dairy specialist at West Virginia University, has been appointed specialist in dairying, vice M. H. Keeney, resigned. Dr. Florence Powdermaker, extension specialist in nutrition, resigned June 1.

North Carolina College.—E. C. Brooks, superintendent of public instruction in North Carolina, has been appointed president of the college, succeeding Dr. W. C. Riddick, who becomes dean of engineering. B. W. Kilgore has been appointed dean of agriculture in the college.

Pennsylvania College.—The new beef cattle barn was dedicated June 13 in connection with Farmers' Day, and is expected to be ready for occupancy July 1. The main structure is 60 by 120 ft. and contains storage for grain and hay, rooms for herdsmen, and an office and laboratory for teaching purposes. An open shed 40 by 320 ft. at one side will provide facilities for experimental feeding, and two large silos of vitrified tile have been completed for some time.

Texas Station.—Dr. G. F. Freeman, chief of the division of plant breeding, has accepted an appointment as director of the recently created Technical Service in the Haitian Department of Agriculture, beginning September 1.

Wisconsin University and Station.—The sum of $1,500 has been placed at the disposal of the college by the Sewerage Commission of the City of Milwaukee for the establishment of a fellowship to study the best methods of using activated sludge as a fertilizer. This material is prepared in large quantities as a by-product in the disposal of Milwaukee sewerage. O. J. Noer has been appointed to the fellowship, which will be under the jurisdiction of the soils department.

A gift of $600 has just been received by the agronomy department from representatives of the paint and varnish manufacturing interests, and flaxseed crushing mills. This is to permit additional investigations to be undertaken in regard to flax culture in the State.

Cooperative work at Brodhead with the Dairy Division of the U. S. Department of Agriculture on the introduction of bacterial cultures in the manufacture of Swiss cheese was resumed on May 15, with the return of C. M. Gere, formerly associated with this work.

The work of the seed inspection laboratory this season has exceeded in amount that done up to the same date in any year since 1915. Over 4,200 samples have already been run, most of them requiring both purity and germination tests, and nearly two-thirds of the total being clover samples.

The State soils laboratory has just closed a contract with one of the leading banks in Milwaukee (acting as trustee) for a soil survey of over 1,000 forties of wild land in Chippewa, Eau Claire, and Washburn Counties. The owners are desirous of knowing what the intrinsic agricultural value of this land is before planning for its development. This work is provided for under the soils laboratory law where the owners pay the cost of such survey. Soil maps will be completed this year for Monroe and Pierce Counties.

The first Transcontinental Dairy Special was sent out in June under the auspices of the college of agriculture and the Live Stock Breeders' Association for a demonstration trip through Wisconsin, Minnesota, North Dakota, Montana, Wyoming, Idaho, Oregon, Utah, Nebraska, and Iowa in cooperation with the agricultural colleges of the respective States. Fifteen animals representative of the best types of the five leading dairy breeds were used for this demonstration work, among them Aggie, the world's champion grade cow, some typical grade heifers which show the results of the use of purebred sires, and representative purebred sires of each breed.

Agricultural Education and Research in Canada.—The first recipient of the Carter medal for outstanding service in connection with the advancement of Canadian horticulture is announced as W. T. Macoun, Dominion horticulturist. It is expected that this medal will be awarded annually.

As an outcome of breeding work by the department of field husbandry of the University of Alberta, a new wheat has been developed for the areas of limited rainfall, which is claimed to give greater length of straw under these conditions. As shown by three years' test, this wheat is 5 in. taller than Marquis, three days later in maturing, equal in milling and baking qualities, and superior by 9 bu. per acre in yield.

An agricultural school to be provided for New Brunswick will be located at the Dominion Experimental Farm at Fredericton. A building will be constructed at once which, it is expected, will be ready for occupancy in September, when the first courses will be given.

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EXPERIMENT STATION RECORD.

VOL. 49. AUGUST, 1923. No. 2.

Experimentation in horticulture was among the earliest and most common lines of inquiry to be undertaken by the experiment stations in this country. In most States it has always been regarded as a major field of activity, and the group of investigators which it has marshalled under its banners has included some of the ablest and most distinguished of the station workers. The record of their achievements has been creditable, and the sum total of their additions to horticultural knowledge very considerable. Most of these pioneer leaders retired from active service some years ago, and with the appearance of a new generation of workers fresh impetus has been given for the development of research on a broader and more fundamental basis.

The importance early attached to horticultural studies was evidenced in the appointment of a special committee on cooperative work in horticulture by the Association of American Agricultural Colleges and Experiment Stations at its second convention, held in Knoxville, Tenn., in 1889. This committee was instructed to devise a plan for cooperation between the various stations in testing new varieties of fruits and vegetables, and in June of that year held a meeting of horticulturists and others at the Ohio Station which was apparently one of the first gatherings of subject matter specialists to assemble in this country. Although only twelve institutions were represented, a list of the station horticulturists of the United States issued a few months later by the committee showed that horticultural work had then been organized in all but seven States, and that in most cases horticulturists had been specifically designated in charge. Ten years later fifty-three of the fifty-six stations were reported as working to a greater or lesser extent in horticulture, testing varieties of vegetables and fruits and making studies in varietal improvement and synonymy. The number of horticulturists was then seventy-seven, constituting about eleven per cent of the total force engaged in administration and inquiry. During the first decade a large amount of work was begun, and the output of publications was quite voluminous. In 1903 it was computed that more than 170

bulletins and reports had been issued on the single subject of the culture of apples.

The prominence given to variety testing in the early days is not surprising in view of the need and usefulness of such tests, the great popular interest in them, and the general expectation that practical results could be readily and quickly secured. In many of the States the prevalence of pioneer conditions made the ascertaining of dependable varieties a wellnigh indispensable preliminary to further horticultural study. Many of the same considerations influenced the conducting of simple cultural tests and fertilizer trials.

A general realization existed, however, that more fundamental inquiries would be required for the permanent advancement of either the science or art of horticulture. In 1891 the view was expressed in these columns that "the horticulturists of the stations are rightly not content to make the testing of varieties the most prominent feature of their work. It is in fact far from the highest form of experimenting, and can not be expected to yield definite and satisfactory results except in narrow lines rationally and patiently worked out. Many of the experiments in methods of culture of various plants are also of very little consequence unless they are planned with reference to certain ulterior ends. The broad basis on which the horticultural work of the stations should be placed involves a comprehensive study of the variations and behavior of plants under culture. The influence of soil, climate, fertilizers, methods of culture, treatment in forcing, etc., should be investigated in the hope of discovering the laws of plant variation and amelioration. When these are once known it will be possible to proceed systematically in the origination and fixation of varieties."

This discussion went on to suggest as attractive fields for experimentation the hybridization of plants, propagation studies, the amelioration of wild fruits, the forcing of plants under glass, and the study of questions relating to manuring. In the years which followed, considerable work was undertaken in all of these directions, although it must be admitted that in far too many institutions the amount of high grade research was somewhat disappointing. For this many contributory factors may be recognized, such as the existence of a large number of practical questions which called for immediate attention, the pressure of heavy burdens of teaching, correspondence, and similar duties, and in many cases the lack of sufficiently broad training on the part of the investigators themselves.

Most of these handicaps will be readily recognized as common to other branches of agricultural science a generation ago, but it is believed that some of them were particularly burdensome in horticulture. In addition there were several special difficulties due to

the complex nature of the subject itself. Thus, as Hedrick has pointed out, "experimenters in horticulture may investigate the phenomena of science, the mechanical methods of an art, and latterly, they have come to have much to do with business affairs." As he went on to say, these distinctions have not always been "clearly defined in the activities of horticulturists. Too often men supposed to be engaged in research work in horticultural science are busy with the art—very often not in discovery or invention in art but simply with the details of well-established art. Much that is put out as the result of research work is a description or a discussion of the technique of horticulture. A study of business methods, pure and simple, is frequently offered as the results of research. These isolated observations on the art and business of horticulture, having no relation to either pure or applied science, ephemeral and of but limited application, bear but poorly the brand of investigation. Data in the art and business of horticulture, to be worth the while of the true research worker, must be a part of the coordinated and classified knowledge of horticulture, must be of more or less universal application, and must deal more or less directly with scientific principles. Investigating is not teaching, nor demonstrating, nor observing, nor describing, nor proving, unless primarily behind any of these is the design to discover laws."

As regards science, horticulture has been characterized as a "no man's land," because of its close relations with botany, chemistry, entomology, bacteriology, and genetics. The active enlisting of these sciences in horticultural problems brought about a great advance in horticultural knowledge. For instance, the discovery of the importance of Mendel's theory of segregation and inheritance of independent factors, early in the new century, imparted a stimulus to plant breeding. Studies in the morphology and functioning of the floral organs and, incidentally, in sterility and fertility of flowers were begun. Likewise, cytological investigations focused attention on the chromosome mechanism of the cell as the physical basis of heredity, and thus opened up an entirely new field of investigation.

The passage of the Adams Act in 1906 had a very beneficial effect on horticulture as well as on other branches of agricultural science. Not only did the increase in funds but also the wise provisions which restricted their use to original researches help to uplift the character of the experimental work. The institutions were enabled to employ the services of better trained men, and these gradually became available in greater numbers. Furthermore, the rapid expansion of the agricultural colleges in the early part of the present century rendered possible more division of the fields of activity. Specialization on closely defined problems became more practicable, and with this specialization came material progress in several directions.

The organization in 1903 of the Society for Horticultural Science brought into being an association which has contributed materially to raising the plane of horticultural investigations in this country. The annual meetings have afforded an opportunity for the discussion of important problems and have served as a special source of inspiration for the younger men. While no journal has been undertaken, the issuance of an annual report has afforded a medium for presenting preliminary reports and discussions of technique, which despite their value might not otherwise have been prepared or found readily available mediums of publication.

The personal factor has played no small part in the development of horticultural science, and acknowledgment should be made to numerous able teachers such as Bailey, Whitten, Beach, and others still in active service who by their zeal and enthusiastic leadership have inspired younger men to high ideals. Around such men have been built up groups among which may be found some of our most efficient and promising investigators.

Opportunity is not afforded for a complete review of the horticultural investigations of recent years, but mention may be made of a few typical researches which illustrate the progress which has been made. One important field has dealt with sterility in orchard fruits. Observations by several workers have demonstrated a high proportion of sterility in many species of cultivated fruits, notably the pear, grape, plum, sweet cherry, filbert, apple, apricot, blackberry, and dewberry. Attempts followed to explain the underlying causes of sterility. Pollen abortion was discovered to be responsible in the grape by the Minnesota Station, while in West Virginia it was learned that the pollen tubes of Rome Beauty apples failed to grow as rapidly in pistils of this variety as in other varieties. Many factors were found to influence the proportion of sterility, such as soil conditions, vigor of the plant, and climatic variations, and from this knowledge constructive suggestions toward a more intelligent selection of varieties and an improved horticultural practice were made possible.

The problem of overcoming variability in fruit stocks has occupied the serious attention of American horticulturists, it having been generally conceded by investigators that the growing of experimental trees on mixed stocks has greatly minimized the value of the results of many otherwise carefully conducted fertilizer and pruning tests. Investigations now in progress indicate that this difficulty may be overcome in the future.

No single problem has roused keener interest among horticultural investigators during recent years than that of bud variation in asexually propagated plants. Shamel and associates, working for the

U. S. Department of Agriculture in southern California, have reported the existence of a large number of variations in horticultural varieties of lemons, oranges, and grapefruit. On the other hand, workers during a long period of years at the Missouri Station with the strawberry and apple have failed to find any evidence of variability due to bud variations. At the Vermont Station, tests of the production of scions from high and low yielding apple trees have shown no evidence of variation due to parentage, while at the Maine Station, variations in the yielding capacities of a large number of Ben Davis apple trees were ascribed to a lack of uniformity in soil and stocks. This large mass of conflicting results leaves the problem still unsolved, but it appears highly probable that certain species of fruits vary much more than others, and the existence of mutations in the apple and other comparatively stable fruits emphasizes the fact that variations do occur even in the most stable species.

Much has been added during recent years to the existing knowledge of fruit buds and the factors influencing their formation. At the Virginia Station it was found that apple buds were differentiated in late June and early July of the year preceding the bearing of fruit, while in Oregon buds of the Yellow Newton apple were differentiated during the first ten days of July. Studies at the New Hampshire Station have indicated that culture and cover crops increase the amount of fruit-bud formation, while fertilizers, when used in connection with culture and cover crops, failed to affect materially the fruit-bud formation. From the Oregon Station studies with the tomato have emphasized the close relationship that exists between the condition of nutrition of plants and their fruitfulness, this being found to depend for the most part on a balanced ratio between the nitrate and carbohydrate contents. Furthermore, the Missouri Station found that apple spurs having a high starch and low nitrogen content at time of fruit-bud differentiation were inclined to develop fruit rather than leaf buds, while studies at the Oregon Station indicated that in the apple the fruit spur is largely a unit, defoliation of individual spurs greatly reducing fruit-bud formation. A correlation between length of apple spurs and their productivity was found at the Wisconsin Station.

Not all of the inquiries initiated by the stations have led to positive findings. Studies of fertilizers have occupied a large part of the effort of many station workers, but it may be questioned whether the results have led to the discovery of any universal principles. In some parts of the country, for example in fertile areas of western New York, fertilizers have proved of little benefit

to the carefully managed apple orchard, and long-time orchard fertilizer studies conducted by the Pennsylvania Station have shown that nitrogen is the only fertilizer element of value in orchards of that State, and then only in the case of sod-grown trees. At the Massachusetts Station, studies extending over a period of twenty years or more have indicated that nitrogen in the form of manure and ground bone increased yields of fruit. So, too, some striking results in the renovation of orchards have been obtained at the Ohio and Oregon Stations and elsewhere. Studies at the Delaware and other stations have indicated that peaches and other short-lived fruits of rapid growth respond more definitely to fertilizers.

The generally accepted theory, held for many years even by station men, namely, that pruning of trees stimulates increased growth and yield, has been disproved by careful investigations at many of the stations. One of the first institutions to report on the deleterious effect of pruning was the Woburn Experimental Fruit Farm in England, where it was found that severe pruning of apple trees limited growth and production of fruit. These results have been corroborated in this country by many different workers, both with the apple at the West Virginia, New York Cornell, New York State, and California Stations, and with the lemon and olive at the California Station. This determination of the deleterious effect of severe pruning may be cited as a definite instance of where careful experimental work has disproved a popular belief which has undoubtedly caused practical orchardists serious financial losses.

An indication of the multifarious horticultural problems still regarded as unsolved is afforded by the unusually large number of projects carried by the stations. The latest list of these projects reports no fewer than 808 classified as horticultural. This is about sixteen per station, a greater number than for any subdivision except field crops, which has 1,535 projects, and is nearly double the third subject listed, plant diseases, which has 419. Over 100 projects deal with apples alone, in addition to 64 with fruits in general and 36 on orchard management. Other promising fields of study are indicated in the 55 projects dealing with floriculture, landscape gardening, and ornamentals, the 25 projects on spraying, and the 46 projects on vegetables and general truck crops.

A closer examination of these projects reveals that much attention is still being given to what may be termed the more elementary lines of inquiry. For instance, over 150 of the projects are variety tests. There is also a large amount of cultural comparisons and similar work, much of which is of considerable practical utility

but perhaps of somewhat limited general application. On the other hand, there are also a large number of the more advanced inquiries under way, particularly as regards matters of plant breeding, pruning, propagation, and other horticultural practices.

One encouraging tendency is the increasing disposition to consider more carefully the development of improved methods or technique. As Chandler has pointed out in a recent address on the trend of research in pomology, many of the earlier field experiments have yielded valuable results only because in the problems studied the differences between plants were very large. As the problems come to deal with the more minute details of horticultural practice, the experimental methods must evidently be so refined as to make the smaller differences encountered really significant. In orchard experiments in particular, the greatest care is evidently essential in the selection of site, replication of plats, and especially in the interpretation of the results themselves. At the same time, there is no reason to suppose that the field experiments can be safely supplemented in entirety by pot tests or other forms of experimentation of that type, useful as these forms may be. Evidently, however, field experiments which may be expected to be of more than local significance must be in reality physiological studies, or else it would seem that physiological studies should supplement the field experiments wherever possible. Whether these studies should be carried on through cooperation with the workers in the associated sciences or by the horticulturists themselves is perhaps less important than that in some way as complete interpretation be obtained as may be forthcoming.

The horticultural interests of this country are so large and increasing in importance so rapidly that the opportunities for research are especially attractive. Comparisons of the recent output of the stations in this field with that of even a decade ago readily demonstrate the progress which is being made and the valuable results which are being secured. Yet much remains to be done. Hedrick, writing in 1914, stated in a discussion of the immediate field at that time that "experimentation is needed in the oldest of horticultural operations—pruning. It must be approached through physiological botany. We know next to nothing about the feeding of plants and the influences of the food elements on plant products—current methods of fertilizing are largely arbitrary. Many questions having to do with sex are before us. There is need of more precise knowledge about bud formation and the setting and dropping of fruits. There is yet much to be done in the classification and description of horticultural plants. More than elsewhere in agricul-

ture, horticultural plants are interplanted as in catch crops, cover crops, and in crop rotation; the interrelationships of plants and the effects of crop residues, therefore, must be studied. Greater knowledge of the associations of plants would throw new light on the relations of climates and soils to plant growing—plant ecology. We have not yet reached the limit of improvement in any cultivated species, and plant breeding must be given attention. The relationships of parasites and hosts involving the whole matter of predisposition, resistance, and immunity offer a series of problems. The good and bad effects of sprays, quite aside from their insecticidal or fungicidal functions, are worthy of study. Much has been written but very little is really known about the reciprocal influences of stock and graft. The whole matter of stocks needs experimental attention, fruit growers in particular having little to guide them in the choice of stocks for the several fruits. We know that cultivated plants vary greatly: are any of the variations heritable or do they appear and disappear with the individual? A study of the last problem would bring one to a much needed investigation of mutations. Acclimatization deserves consideration. There yet remain many native plants worthy of domestication. Forcing of plants brings up many problems; as, the influence of heated soils and atmospheres, soil sterilization, artificial lights in place of sunlight, the use of electricity in forcing growth, and the physiological disturbances of the plant brought about by the changed environment. Lastly, those who ship and store horticultural products are calling for experimental aid to solve their many problems."

Many of these problems have received consideration since these words were written, and others have arisen, yet in how few of them has a final answer been forthcoming. Their continued existence constitutes both a challenge and an opportunity.

RECENT WORK IN AGRICULTURAL SCIENCE.

AGRICULTURAL CHEMISTRY—AGROTECHNY.

Catalytic action, K. G. FALK (*New York: Chem. Cat. Co., Inc., 1922, pp. 172*).—In this volume catalytic reactions are considered, not from the point of view of their own distinctive behavior primarily, but in their relationship to chemical reactions in general. "In this way it is hoped to show the relations of catalytic reactions to other reactions, and in a measure to unify the phenomena of chemistry in place of creating new branches or subdivisions. Also, it is to be seen that catalytic reactions exemplify certain relations which are not as apparent in other reactions. In this way a study of such reactions may extend and strengthen the concepts of chemical theory."

The theory of emulsions and emulsification, W. CLAYTON (*London: J. & A. Churchill, 1923, pp. VIII+160, pls. 4, figs. 18*).—This monograph, which contains a foreword by F. G. Donnan, deals with the theoretical aspects of emulsions and emulsification, with such references to technical applications as are necessary to illustrate some particular laboratory method on a large scale or some important theoretical point. The method of treatment, while historical to a certain extent, in general follows a logical line of development based upon modern physico-chemical principles. Literature references are given both as footnotes and in a very complete bibliography arranged in chronological sequence, with the papers for each year in alphabetical order of authors.

Bibliography of colloid chemistry, H. N. HOLMES (*Washington: Natl. Research Council, 1923, pp. III+135*).—This preliminary bibliography on colloid chemistry contains about 1,800 references to the literature on the subject through the early months of 1922. The references are classified as to subject and arranged chronologically in each class. In most cases a brief comment is included on the scope or general nature of the paper.

The colloidal state in its medical and physiological aspects, W. M. BAYLISS (*London: Henry Frowde and Hodder & Stoughton, 1923, pp. VIII+95, figs. 12*).—This small volume deals in a concise manner with the properties of colloids, both physical and chemical, of interest in connection with physiological phenomena. The various chapter headings are as follows: The nature of the colloidal state, interfacial phenomena, precipitation and peptonization, osmotic pressure, viscosity, surface tension of colloidal solutions, imbibition, physiological action, and proteins and hemoglobin.

Proteins and the theory of colloidal behavior, J. LOEB (*New York and London: McGraw-Hill Book Co., Inc., 1922, pp. XI+292, pls. 2, figs. 78*).—Part 1 of this volume presents in detail the proofs of the author's theory that the proteins combine with acids and alkalis according to the stoichiometrical laws of classical chemistry, and that consequently the chemistry of the proteins does not differ from the chemistry of crystalloids.

Part 2 consists of the development of a mathematical and quantitative theory of colloidal behavior on the basis of Donnan's theory of membrane equilibria.

The precipitation of proteins from cereal extracts by sodium tungstate, L. A. Rumsey (*Indus. and Engin. Chem., 15 (1923), No. 3, pp. 270–272*).—This paper describes in detail the technique employed in the removal of proteins from flour or cereal extracts by the use of the Folin-Wu sodium tungstate reagent as previously noted (E. S. R., 48, p. 504).

Note on the isoelectric point of muscle protein, K. O. Granström (*Biochem. Ztschr., 134 (1923), No. 5–6, p. 589*).—The average isoelectric point (four determinations) of myosin isolated from rabbit muscle is given as pH=3.92.

Chemist's calendar, 1923, I, II, W. Roth (*Chemiker-Kalender. Berlin: Julius Springer, 1923, vols. 1, pp. XIII+528, figs. 11; 2, pp. XII+655, pl. 1, figs. 71*).—This is the revision for 1923 of the handbook previously noted (E. S. R., 47, p. 201).

Methods of organic chemistry.—II, Special, edited by J. Houben (*Die Methoden der Organischen Chemie. II, Spezieller Teil. Leipzig: Georg Thieme, 1922, 2. ed., rev. and enl., vol. 2, pp. XXVII+1115, figs. 44*).—This is the second volume of the revision of Weyl's Die Methoden der Organischen Chemie, the first volume of which has been noted previously (E. S. R., 46, p. 9).

Lunge-Berl chemical-technical methods of analysis, I, II, edited by E. Berl (*Lunge-Berl Chemisch-technische Untersuchungsmethoden. Berlin: Julius Springer, 7. ed., rev. and enl., 1921, vol. 1, pp. XXXII+1099, pl. 1, figs. 291; 1922, vol. 2, pp. 1411, figs. 312*).—The seventh edition of this work has been edited by E. Berl with the assistance of a large number of collaborators. In addition to a revision of the material of the previous edition (E. S. R., 22, p. 508; 25, p. 106), a number of new sections have been added.

A new viscometer, P. Lecomte du Noüy (*Jour. Gen. Physiol., 5 (1923), No. 4, pp. 429–440, figs. 6*).—A viscometer of high sensitivity, depending upon the principle of coaxial cylinders, is described and illustrated, with directions for its standardization and use. The apparatus, which requires less than 1 cc. of liquid, is thought to be particularly adapted to the measurement of colloidal solutions and physiological liquids. It is stated that the readings are rapid, the temperature is easily controlled and varied, and the range is considerable and easily changed. Its main advantage is thought to be that it makes possible the observation of the changes occurring in the viscosity of the liquid in functions of time and temperature.

The measurement of H-ion concentration by the colorimetric method in culture media and biological media, G. Abt (*Rev. Hyg., 45 (1923), No. 1, pp. 1–43, fig. 1*).—This is a discussion, with many references to the original literature, of the principles of H-ion concentration determination, the technique of various colorimetric methods for this determination, and some of the advantages in its use with culture media.

A new reaction of free tryptophan, P. Danila (*Compt. Rend. Soc. Biol. [Paris], 88 (1923), No. 4, pp. 278–280*).—The author states that if to 0.1 cc. of a 4 per cent solution of iodic acid is added 0.1 cc. of a solution of tryptophan, the concentration of which may vary from 1 part in 200 to 1 part in 50,000, and the mixture is heated to boiling on a water bath, free iodin is evolved as noted by the color and odor. The test can be made more delicate by adding to the solution, after heating, 0.1 cc. of a 1 per cent solution of starch paste. If tryptophan is present a rose-colored ring appears at the juncture of the two liquids, and after a little while the starch solution is colored from rose to indigo, depending upon the amount of iodin used.

It is stated that this reaction is not given by albumin, globulin, hemoglobin, albumoses, peptones, agar, or gelatin, or by any amino acids other than trypto-

phan, and that solutions of ammonium phosphate, sodium chlorid, sodium phosphate, acetone, formaldehyde, phenol, glucose, urea, indol, and skatol are equally without action. Calcium chlorid has been found to give the same test, but only in very concentrated solution.

The use of persulphate in the estimation of nitrogen by the Arnold-Gunning modification of Kjeldahl's method, S. Y. Wong (*Jour. Biol. Chem., 55 (1923), No. 3, pp. 427–430, fig. 1*).—The use of potassium persulphate is recommended in the determination of total nitrogen by the Arnold-Gunning modification of the Kjeldahl method. The most favorable time for adding the persulphate has been found to be at the latter stage of the digestion and in the presence of moisture. The technique of the method, using 5 cc. of urine, diluted blood, or milk, or 0.5 gm. of protein, is as follows:

The weighed material is transferred to a clean 800 cc. Kjeldahl flask and washed down with as little water as possible. After the addition of 2 cc. of 5 per cent copper sulphate, 5 gm. of pure potassium sulphate, 20 cc. of concentrated nitrogen-free sulphuric acid, and a few clean quartz pebbles, the mixture is heated gently on the digestion shelf until vigorous frothing ceases, and then strongly until the liquid turns amber color, this point being reached in from 20 to 30 minutes. The flame is then turned off and the flask allowed to cool for 10 minutes, after which about 3 cc. of distilled water is added cautiously from a pipette and allowed to mix gradually with the hot acid. During this process the flask should be held with its mouth away from the face. The flask is then set upright and 10 gm. (or 3 in the case of urine) of potassium persulphate is dropped in. The flask is rotated to mix the contents and heated until the mixture turns green, which usually takes about 15 minutes. After cooling for 10 or 15 minutes, 300 cc. of distilled water is added cautiously, followed by a little talcum powder to prevent bumping. The distillation of ammonia is then conducted in the usual manner.

Comparative determinations of total nitrogen in various materials by the old and new methods are reported, the results in all cases being slightly higher with the new method. The most important advantage in the proposed modification is thought to be in its speed. As illustration of this point, data are reported on the nitrogen obtained in one-half hour intervals of time in the digestion of milk by the old and the new methods. In the latter case the digestion was completed in 40 minutes of actual heating, while in the former it required about two and one-half hours.

The use of persulphate in the estimation of nitrogen by Folin's direct nesslerization method, S. Y. Wong (*Jour. Biol. Chem., 55 (1923), No. 3, pp. 431–435*).—The use of potassium persulphate is also recommended for the determination of total nitrogen in urine, blood, and milk by the Folin direct nesslerization method. The sulphuric acid is used alone for the preliminary digestion, after which the potassium persulphate is added. The technique is described for the slightly different procedures which have been worked out for this determination in urine, blood, and milk.

The determination of so-called assimilable phosphoric acid in arable soils, C. Brioux (*Ann. Sci. Agron. Franç. et Étrangère, 39 (1922), No. 2, pp. 82–100*).—The methods of Dyer (E. S. R., 5, p. 1009) and of Schloesing (E. S. R., 11, p. 131) for the determination of available phosphoric acid and potash in soils are described and discussed, and the results are reported of a comparative study of these two methods conducted, at the Station of Agronomy at Rouen, on 38 samples of soil varying in basicity from 300 to 4,000 mg. of N_2O_5 per 25 gm. of sample.

From the results of these analyses, the Dyer method is criticized as not being equally applicable to noncalcareous and calcareous soils and of dis-

solving too easily the phosphates of iron and aluminum, considered by the majority of agronomists to be less easily accessible to the plant than the phosphates of calcium and magnesium. The method is considered, however, to be of considerable value in the analysis of certain soils of variable fertility but showing only insignificant differences by other methods. The Schloesing method is considered to have the advantage of being more rapid, equally applicable to calcareous and noncalcareous soils, and capable of permitting a better classification of soils which are benefited in varying degrees by the addition of phosphoric acid.

The gravimetric determination of organic phosphorus, W. Jones and M. E. Perkins (*Jour. Biol. Chem., 55 (1923), No. 3, pp. 343–351*).—The method described consists essentially in the oxidation of the material with concentrated sulphuric acid, potassium sulphate, and a little copper sulphate as in the ordinary Kjeldahl nitrogen method, and the subsequent precipitation of the phosphorus as magnesium ammonium phosphate from the diluted digestion liquid made alkaline with ammonia and treated with ammonium molybdate solution. Under these conditions the magnesium ammonium phosphate forms large stable crystals containing 6 molecules of water of crystallization, 5 of which are easily driven off at 105° C., while the sixth remains at 130°. On account of the stability of this compound under ordinary conditions, it is recommended as a useful stock material for the preparation of standard solutions of its constituents. Data are given on the accuracy of the various steps of the proposed method.

The action of soluble calcium salts on the quantitative determination of glucose, and an explanation of this action, W. Biehler (*Ztschr. Biol., 77 (1922), No. 1–3, pp. 59–72, fig. 1*).—Soluble calcium salts are shown to cause a loss of copper in the quantitative determination of glucose with Fehling's solution, this loss being proportional to the amount of copper present. Barium and strontium behave similarly, but magnesium, zinc, and lithium have no effect. It is stated that this source of error can be avoided by preliminary precipitation of the calcium, barium, or strontium, and that an excess of the precipitant, ammonium oxalate, or sodium fluorid is harmless. The loss is attributed to the intramolecular transformation of dextrose in the presence of calcium into saccharic acid or its calcium salt.

Further researches on the identification of inulin and maltose by a mycological method.—Cases of maltosuria, A. Castellani and F. E. Taylor (*Jour. Trop. Med. and Hyg. [London], 26 (1923), No. 4, pp. 59–62*).—This paper describes in detail the application of the method previously noted (E. S. R., 47, p. 205) to the determination of inulin and maltose. In connection with the latter determination, its use in detecting maltosuria is described, with an illustrative case report.

The acids of preserved fruits, C. F. Muttelet (*Ann. Falsif., 15 (1922), No. 175, pp. 453–455*).—Continuing the examination of various fruits for the nature of their organic acids (E. S. R., 22, p. 65; 47, p. 807), the author reports the absence of tartaric acid in apricots, peaches, and several varieties of plums. Plums contain citric but no malic acid, and apricots and peaches both citric and malic acid. Consequently the addition of apple juice to the latter in preserving the fruit can not be detected by a malic acid determination.

A table is given in which the values obtained for malic and citric acids in the present and previous studies are summarized.

The conversion of macro methods in food chemistry into half micro and micro methods.—III, Half microchemical determination of water, fat, and salt in butter and other food fats, H. Lührig (*Pharm. Zentralhalle, 63 (1922), No. 39, pp. 505–508*).—Continuing the series previously noted (E. S.

R., 47, p. 805), the methods are described for the determination of moisture, fat, and salt in 1 gm. samples of butter. The sample is heated in an aluminum or porcelain crucible over a small flame until it forms a fine foam with a slight brown color and aromatic odor, the process requiring about a minute. The crucible is then cooled in a desiccator and weighed to determine the moisture content. The residue from the moisture determination is treated several times with a few cubic centimeters of ether, which is then filtered into a small beaker and evaporated and the residual fat weighed. The residue from the ether extraction is dissolved in warm water and titrated with standard silver nitrate solution for chlorin.

Exposure to light as a source of error in estimating uric acid by the Folin and Wu method, H. Rogers (*Jour. Biol. Chem., 55 (1923), No. 3, pp. 325–331*).—The author has found that exposure to light may lead to low results in the estimation of uric acid in blood by the Folin-Wu method (E. S. R., 41, p. 13), and consequently recommends that in this determination the centrifuge tubes containing the silver precipitate be protected from light until the redissolved uric acid has been decanted from them.

The determination of creatinin in the blood, E. Moreau (*Compt. Rend. Soc. Biol. [Paris], 88 (1923), No. 4, pp. 249–251, fig. 1*).—The apparatus previously described (E. S. R., 48, p. 411) has been used for the colorimetric determination of creatinin by the Folin picric acid method.

Colorimetric determination of iron and hemoglobin in blood, S. Y. Wong (*Jour. Biol. Chem., 55 (1923), No. 3, pp. 421–425*).—In the method described, which requires 1 cc. of blood, the proteins are first completely destroyed by the action of concentrated sulphuric acid and sodium or potassium chlorate, and the resulting solution is treated directly with ammonium thiocyanate and compared in a Duboscq colorimeter with a standard iron solution treated in the same way. The method is recommended as a substitute for the determination of hemoglobin, the advantages being that it is applicable to old, as well as to fresh, blood, and that the standard solution is easily prepared and keeps indefinitely.

Lead studies.—I, The estimation of minute amounts of lead in biological material, L. T. Fairhall (*Jour. Indus. Hyg., 4 (1922), No. 1, pp. 9–20*).—A critical review of the literature on the determination of small amounts of lead is followed by the description of a volumetric method which is said to have an average error of only 5 per cent in determinations on biological materials containing less than 1 mg. of lead.

In the method as described, the material is ashed in an electric muffle at a temperature below red heat, and the ash is dissolved in water, neutralized with sodium hydroxid if it has been necessary to add a considerable amount of acid during the ashing, and then made slightly acid with hydrochloric acid, after which the lead is precipitated with hydrogen sulphid. The precipitate is washed with boiled distilled water and dissolved in a small amount of concentrated nitric acid, the solution boiled to expel hydrogen sulphid, neutralized with sodium hydroxid, and acidified with acetic acid, after which an excess of potassium chromate is added and the solution boiled. If lead is present in very small amounts the solution is allowed to stand over night before filtering. The precipitated lead chromate is washed thoroughly with warm water to remove excess potassium chromate and then washed on the filter paper with a small amount of hydrochloric acid, followed at once with warm water. The lead chromate is then dissolved in hydrochloric acid and the lead estimated by adding an excess of potassium iodid and titrating the iodin liberated with N/200 sodium thiosulphate solution.

An extensive bibliography is appended.

Lead studies.—II, A critical note on the electrolytic determination of lead in biological material, A. S. MINOT (*Jour. Biol. Chem., 55 (1923), No. 1, pp. 1–8*).—A further study of the electrometric method of Denis and Minot for determining lead in biological materials (E. S. R., 41, p. 413) has shown various sources of error which tend to balance each other and give roughly quantitative but not reliable results. The principal errors on the negative side are losses of lead through the solution of the precipitated sulphids during washing and through incomplete electrolytic separation, and on the positive side deposition of manganese dioxid. Fairhall's chromate method noted above has been found to be more accurate and practical than the electrolytic method, and is recommended as a substitute for the latter.

The determination of ether in alcohol-ether mixtures, E. C. FREELAND (*La. Planter, 69 (1922), No. 6, pp. 87–89, figs. 3*).—This is a compilation with references to the original literature of suitable methods for determining ether in alcohol-ether mixtures such as are used as substitutes for gasoline.

Preparation of absolute alcohol with calcium chlorid and lime, W. A. NOYES (*Jour. Amer. Chem. Soc. 45 (1923), No. 3, pp. 857–862, figs. 2*).—An apparatus for preparing alcohol of at least 99 per cent concentration by distillation over calcium chlorid is described and illustrated, together with a simpler apparatus for further concentrating the alcohol by distillation over lime. This apparatus consists essentially of a 12-liter flask provided with a reflux condenser and a trap to prevent the lime from being carried over mechanically with the alcohol vapor. The condenser is provided with an outlet tube which can be closed with a pinch cock or opened to permit the condensed alcohol to pass through and be collected.

For the practical laboratory preparation of absolute alcohol in case the apparatus for use with calcium chlorid is not available, the second apparatus is used as follows: Ten liters of 92 per cent alcohol and 2,000 gm. of lime are heated in the flask under the reflux condenser for 24 hours, at the end of which time the alcohol is distilled off, refluxed again for 24 hours with 350 gm. of lime, and again distilled off. The alcohol, which at this point is usually turbid, is then mixed with 50 per cent more than the required amount of calcium oxid prepared by heating hydrated lime and with anhydrous calcium chlorid amounting to 10 or 15 per cent of the lime used. This mixture is heated under the reflux condenser over night and the alcohol then distilled off. The concentration of alcohol at the end of each of the three steps of this method is about 99, 99.7, and 99.9 per cent, respectively.

Chemical manual for millers and bakers, H. KALNING (*Das Chemische Praktikum des Müllers und Bäckers. Leipzig: Wilhelm Engelmann, 1921, pp. 75*).—This is a laboratory manual of chemical methods employed in baking technology.

Flavoring materials, natural and synthetic, A. CLARKE (*London: Henry Frowde, 1922, pp. XXI+166, figs. 11*).—This is a comprehensive reference book on spices and condiments; miscellaneous animal and vegetable flavoring materials; essential oils; terpeneless and sesquiterpeneless oil; floral, fruit, and compounded flavors; and odorous organic compounds. In general the information on the various substances includes sources, methods of preparation, physical and chemical characteristics, and analytical tests. An introductory chapter on the sense of taste is included.

Homemade apple and citrus pectin extracts and their use in jelly making, M. C. DENTON, R. JOHNSTIN, and F. W. YEATMAN (*U. S. Dept. Agr., Dept. Circ. 254 (1923), pp. 11*).—In this circular household methods for extracting pectins from whole apples and the fresh or dried white peel of oranges or lemons are described; various uses which can be made of these extracts are

discussed, with particular reference to the fruits which require or are benefited by the addition of pectin and the best kind of pectin extract for combining with the different fruits; and directions are given for making several typical kinds of jellies by the addition of these extracts. A score card for judging jellies according to package, color, clearness, texture, and flavor is appended.

Processing of corn, W. D. Bigelow (*Canner, 56 (1923), No. 10, 11, pp. 169, 170*).—The minimum temperatures of processing corn to destroy the most resistant strains of *Bacillus botulinus* are given as 65 minutes at 240° F., 55 minutes at 245°, and 50 minutes at 250° for No. 2 cans, and 160 minutes at 240°, 145 minutes at 245°, and 135 minutes at 250° for No. 10 cans. It is emphasized that in processing corn the initial temperature must be at least 180°, and that the cans must be cooled to room temperature throughout before being stacked.

METEOROLOGY.

Lunar periodicity in living organisms, H. M. Fox (*Sci. Prog. [London], 17 (1922), No. 66, pp. 273–282; also in Cairo Sci. Jour., 11 (1923), No. 109, pp. 45–57*).—In this article popular notions regarding lunar influences on living organisms are reviewed and in large part discredited, but observations and investigations by the author and others are cited to show periodicity in certain marine animals apparently attributable to lunar influence. Few well authenticated cases of the influence of the moon on plant growth are cited. Attention is, however, called to Musset's observation that certain flowering plants are photographic to moonlight, Loftfield's observation that at night stomata open under the influence of moonlight, and Semmens' observation that moonlight increases the velocity of germination.

Weather and the crop yield in the northeast counties of Scotland, A. E. M. Geddes (*Quart. Jour. Roy. Met. Soc., 48 (1922), No. 203, pp. 251–268*).—The present paper may be regarded as supplementary to the work of Hooker (E. S. R., 19, p. 414).

As regards barley and oats the conclusion is reached that "the weather of winter and early spring apparently plays very little part in the yield. Both crops demand a summer rainfall rather above the normal. The extra precipitation is required earlier in the season for barley than for oats. Both also agree in requiring an accumulated temperature above the normal, the amount required by barley being greater than that necessary for oats. Oats, however, require the excess of temperature to be maintained longer into the autumn.

"The connection between the root crops and the weather is not so marked as it is in the case of the cereals. Both apparently prefer a season with rainfall rather below the normal. As regards accumulated temperature the potato crop prefers a season in which there is an excess, while the yield of the turnip crop is improved by a cold winter previous to sowing. The summer temperature appears to play only a small part.

"The weather of the preceding year seems to influence the yield of hay as much as that of the year of harvesting. A warm summer, experiencing a rainfall a little in excess of the normal, and following a dry period in late winter, are apparently the conditions during the 'preceding' year which are followed by best results. For the year of harvesting a mild winter and spring during which the rainfall is above the normal, followed by a cool dry summer, provide the conditions which seem to be most beneficial for producing a good yield."

The climate of Nebraska, G. A. Loveland (*Nebr. Agr. Col. Ext. Circ. 14 (1923), pp. 16, figs. 8*).—This circular, based upon all available records, some of which date back to the fifties, discusses in a brief popular way the factors which determine the general climatic conditions of the State, the amount and

distribution of sunshine and precipitation, temperature, dew and frost, clouds, and wind, and gives simple directions for making the principal weather observations.

Meteorological records at Bozeman, E. BURKE (*Montana Sta. Rpt. 1921, pp. 91–94*).—The data recorded during 1921 and summarized in tables in this report include maximum and minimum temperatures, thermograph records, wet and dry bulb readings (morning and night), evaporation, hours of sunshine, wind velocity and direction, barometric pressure, and precipitation.

The mean temperature for the year was 1.1° above normal. The highest temperature was 93° F., July 20; the lowest, —23°, November 19. The last killing frost in spring occurred May 3; the first in the fall, September 9. The precipitation for the year was 15.21 in. This was 3.81 in. below normal. The rate of evaporation was greater than for the year 1920 but much less than for 1919. The number of clear days was 138.

SOILS—FERTILIZERS.

[Soil studies at the Montana Station], E. BURKE (*Montana Sta. Rpt. 1921, pp. 45–48, figs. 2*).—Studies to determine the influence of different methods of cropping and cultivation upon the rate at which soil nitrogen becomes available to plants are said to have shown that nitrogen became available most slowly in undisturbed virgin soils and most rapidly in summer-fallowed soils, manured soils, or in soils supporting cultivated crops. An intermediate rate of availability was found in soils cropped each year to small grains. The results showed further that the rate can be increased by adding lime to those soils which indicate an acid or even a neutral reaction with litmus paper.

Data accumulated from several years' studies of soil troubles showed that an excess of alkali salts and a lack of nitrogen are the principal causes of infertility in Montana soils. The alkali salts are found most largely in irrigated districts, while the nitrogen is lacking in a considerable portion of both the irrigated and dry lands. The corrugation system of irrigation, as practiced for cultivated crops, has been found to favor nitrification much more than the flood system used for irrigating grain crops. Surface samples have been collected in some places which have contained more than 4 per cent of sodium nitrate. Fertilizer experiments are said to have demonstrated quite clearly the need of a greater nitrogen supply to restore the normal growth and health of orchards, and that the application of a nitrate fertilizer followed by clover as a cover crop helps to lessen the trouble due to a deficiency in available nitrogen.

Analyses of soils of Madison County [Ga.], L. M. CARTER, M. W. LOWRY, W. O. COLLINS, and R. M. SOULE (*Ga. Agr. Col. Bul. 268 (1922), pp. 35, figs. 4*).—This report supplements the physical report of the soils of Madison County, issued in cooperation with the U. S. D. A. Bureau of Soils (E. S. R., 44, p. 812), and contains the results of chemical analyses and cropping experiments of the prevailing soil types of the county to determine their fertility requirements and crop adaptations. These indicate that the principal upland soils of the county are deficient in nitrogen and phosphoric acid but, with certain exceptions, are fairly well supplied with potash.

Pedomorphological studies in the neighborhood of Pulawy, T. MIECZYŃSKI (*Pam. Państ. Inst. Nauk. Gosp. Wiejsk. Puławach (Mém. Inst. Natl. Polonais Écon. Rurale Puławy), 2 (1922), A, No. 1, pp. 25–92, figs. 5*).—The results of morphological studies of the prevailing soil types in the vicinity of Pulawy in Galician Austria are reported, particular reference being made to podsol types brought out in examinations of soil profile.

Two characteristic morphological series of podsol soils were observed. One series has resulted from the leaching of a single stratum and the second from the leaching of two individual strata. The first series apparently adapts itself to the form of the land. The most attention was devoted to soils of moderately and slightly podsol nature, and an analysis of the strata of these types indicates that in moderately podsol soil the differentiation of the soil mass appears much more strongly than in the slightly podsol series. The opinion is expressed that hygroscopic measurements in the several strata may be used as a means of determining the degree of differentiation of the soil mass.

Some relations of organic matter in soils, F. A. CARLSON (*New York Cornell Sta. Mem. 61 (1922), pp. 3–27, figs. 2*).—A study of the effect of various treatments and cropping systems on the organic carbon and nitrogen contents of Dunkirk clay loam soil is reported. The experiment was conducted in two series of 8 and 10 years' duration on $\frac{1}{100}$ acre plats. The treatments included manure, potassium, and lime, and the cropping consisted of a rotation without legumes, a rotation with legumes, and permanent grass. The first and second foot strata of the plats were sampled before and after treatment and determinations made of the organic carbon and nitrogen contents.

The results of the two series compared favorably. In general, the limed plats in both series contained more organic carbon and nitrogen than did the unlimed plats. There was a decrease in organic carbon and in nitrogen on the plats in rotation without legumes, and the grassed plats showed an increase in these constituents.

The plats in rotation with legumes contained more nitrogen than those in rotation without legumes. The increase in nitrogen content of the plats in rotation with legumes was greater in limed than in unlimed plats. This is taken to indicate that the legumes had some influence on the nitrogen content of the soil studied. The organic carbon and nitrogen contents were lower in the 8-year than in the 10-year series, and the limed plats produced higher crop yields than did the unlimed plats.

Since the 10-year plats gave higher crop yields than the 8-year plats, the results as regards organic carbon and nitrogen are taken to indicate that there is some relation between organic carbon and nitrogen and the yields of crops. The crops in rotation with legumes removed more nitrogen from the soil than those in rotation without legumes. The grassed plats lost less nitrogen to the crops than did the plats in rotation with legumes. There was a close relation between the organic carbon and the nitrogen, the ratio being wider in the first foot of soil than in the second foot.

A bibliography is appended.

Soil biology [studies at the Pusa Research Institute], C. M. HUTCHINSON (*Agr. Research Inst., Pusa, Sci. Rpts., 1921–22, pp. 38, 39, 40, 41*).—In studies of nitrogen fixation, experiments on symbiosis between algae and nitrogen-fixing bacteria and on the value of plant residues as nutrients for nitrogen-fixing bacteria showed that the abundant algal growth which took place in suitable media inoculated with soil and exposed to diffuse daylight was accompanied by a much higher fixation of nitrogen than in duplicate sets of medium kept in the dark, where algal growth was not visible. Fermented green manure was found to contain a readily available supply of nutrient for Azotobacter.

Studies of the nitrification of mahua cake composted with nodule phosphate alone or with sulphur and soil showed that with fresh cake the original nitrate nitrogen of the soil disappeared after 1 week, and the amount of nitrate then gradually increased in 8 weeks to about the original amount. After a further 10 weeks, the nitrate amounted to the original quantity in the soil plus 18

per cent of the added nitrogen. When the compost was added to the soil nitrification proceeded slowly but steadily, and after 18 weeks up to 40 per cent of the added nitrogen was recovered as nitrate. The addition of the other ingredients of the composts directly to the soil slightly retarded the rate of nitrification of the mahua cake.

A continuation of studies on the solubilization of rock phosphate (E. S. R., 47, p. 515) showed that varying amounts of the phosphoric acid of Trichinopoly nodule phosphate were rendered citrate soluble by various composts. The maximum amount of soluble phosphate was found after from 16 to 20 weeks, beyond which time it decreased. The most effective compost tried consisted of nodule phosphate, mahua cake, and sulphur. The addition of soil to this compost lowered the percentage of soluble phosphate, and the substitution of green manure for the cake produced only two-thirds as much soluble phosphate.

Observations on the losses of nitrogen from cattle dung and urine when stored separately or in mixture showed that greater losses occurred when these were stored in mixture. While the urine lost most of its nitrogen when stored under aerobic conditions, there was little loss after many months storage under anaerobic conditions. A thin layer of oil on the surface of urine provided the necessary anaerobic conditions.

Analyses of burned and unburned field soils showed that the burned soil contained more nitrogen as ammonia than the fresh soil. Experiments on ammonification and nitrification of oil cake showed that greater accumulations of ammonia but less of nitrate took place in the burned than in the unburned soil. Inoculation of burned soil with fresh soil had no effect.

Nitrogen fixation work [by the Ganji Bar Experimental Station, Punjab], P. E. Lander (*Punjab Dept. Agr. Rpt., 1921, pt. 2, p. 38*).—The results of three years' studies on nitrogen fixation in soils are briefly summarized. These indicated that no conclusions can be drawn at present as to the connection between nitrogen fixation and rainfall.

Experiments on the effect of cultivation on nitrogen fixation gave contradictory results, indicating a loss on both cultivated and uncultivated soils. The loss was greater, however, from the uncultivated soil, and no conclusions are drawn.

Studies of the influence of soil condition on bacterial life and the transformation of matter in soils.—II, The capacity of soil for decomposing mannite, H. R. Christensen (*Tidsskr. Planteavl, 28 (1922), No. 1, pp. 1–61, figs. 5; abs. in Internatl. Inst. Agr. [Rome], Internatl. Rev. Sci. and Pract. Agr., 13 (1922), No. 3, pp. 306, 307*).—In a further contribution to the subject (E. S. R., 34, p. 813), studies on the influence of the nature of a soil on its capacity for decomposing mannite are reported.

Preliminary studies of methods of procedure indicated that the moisture content of a soil determines the rapidity as well as the course of the decomposition of mannite, and that in order to attain the approximate maximum decomposition the humidity must be about 75 per cent of the water capacity of the soil. Both inoculated and uninoculated cultures were investigated, and partial chemical analyses were made.

The rate of mannite decomposition was found to vary within very wide limits. In certain cases the process was complete in 5 days, while in others it was not complete even at the end of 30 days. These results are taken to indicate that there is a definite relation between the reaction of the soil, especially where it approaches the point of neutrality, and its power for decomposing mannite. Soils well supplied with lime generally had a greater capacity than those deficient in lime and containing no Azotobacter. A greater

difference was noticeable when distinctly acid or alkaline soils were compared. However, noticeable exceptions to this rule were observed, which on the one hand seemed to indicate that soils containing sufficient lime possess the qualities determining the rapidity of the mannite decomposition process more often than those deficent in lime, while on the other hand no relation was established between the content of phosphoric acid in the soil soluble in hydrochloric acid and its capacity for decomposing mannite.

It was further found that soils well supplied with lime and containing considerable phosphoric acid soluble in water saturated with carbon dioxid also had a marked capacity for decomposing mannite, especially when the soils were inoculated. Since the differences in mannite decomposition which may be attributed to inoculation were slight, it is considered justifiable to conclude that the degree to which mannite is decomposed in soils depends chiefly upon their chemical composition.

In studies in which soils were treated with lime and various phosphatic salts it was found that the rapidity of mannite decomposition depended upon the presence of slightly basic lime compounds and readily soluble phosphoric acid.

Experiments with field soils to determine the extent to which the speed of mannite decomposition in soils needing no lime may be an index of the amount of available phosphate compounds present showed that soils which had previously proved to be deficient in phosphoric acid had a very low capacity for decomposing mannite, while soils well supplied with phosphoric acid decomposed mannite quickly. When normal amounts of available phosphoric acid were applied over a period of years to soils deficient therein, the mannite decomposing capacity of these soils was greatly increased. While these results were considered to be significant, they are not thought to be sufficiently extensive to warrant any final conclusions as to the practical value of this method for determining the phosphoric acid requirements of the soil.

Final studies on the relation between the reaction and the basic character of the soil and its contents of soluble phosphoric acid, lime, and magnesia indicated very clearly that the presence in soil of an alkaline reaction and of certain basic compounds such as lime are necessary conditions for a rather high content of soluble phosphoric acid. It was also found that the form in which phosphoric acid occurs in soils is determined to a large extent by their reaction.

Biological fixation of air nitrogen and the dissolution of organic nitrogen by certain soil bacteria, G. Truffaut (*Jardinage, 10 (1923), No. 70, pp. 209–212, 218*).—A review is given of recent studies on the influence of partial sterilization on the bacterial activities of soils, particularly ammonification, nitrification, and nitrogen fixation. Special attention is drawn to recent work by the author which showed the effectiveness of partial sterilization of soils with calcium sulphid in ultimately increasing the available nitrogen content.

It has been found possible to measurably increase the processes of ammonification and nitrogen fixation in soils, provided they are neutral or at least nonacid in reaction and contain sufficient of the chemical elements required in the nutrition of the bacteria involved. The addition of a small quantity of available nitrogen to soil has been found to result in a marked increase in nitrogen fixation and ammonification. The necessity of sufficient moisture and of the maintenance of a temperature of not less than 10° C. (50° F.) is emphasized.

The movements of nitrates in the soil and subsoil, W. H. Harrison (*Agr. Research Inst., Pusa, Sci. Rpts., 1921–22, pp. 30–32, pl. 1*).—Studies of the movements of nitrates in the soil and subsoil with a view to correlating them with seasonal and cropping variations showed that the distribution of nitrates

through the subsoil is determined by climatic factors and the physical character of the subsoil layers, and that the growth of the crop is in turn controlled to a considerable extent by this distribution.

Biochemical method for determining the productivity of soil, J. STOKLASA (*Chem. Ztg., 46 (1922), No. 91, pp. 681–683*).—The author summarizes the results of studies by himself and others in support of his argument that the productive power of a soil may be measured in considerable degree by determining its bacterial content, its content of easily decomposable organic matter, and its ability to produce carbon dioxid. The radioactive powers of soils of volcanic origin are also considered to materially influence bacterial activity and productivity.

A source of error in pot culture experiments, C. M. HUTCHINSON (*Agr. Jour. India, 17 (1922), No. 5, pp. 507–509, pl. 1*).—Attention is drawn to the error introduced by variations in the porosity of pots used in pot culture experiments due to the wearing off of the glazing with age. Experiments showed that in old pots outward water movement through the walls carried off some of the excess of nitrate and markedly reduced the concentration of this salt in the soil. These observations are taken to indicate the necessity of utilizing some other method of securing nonporosity than that provided by ordinary glazing.

Examination of soil gases, W. H. HARRISON (*Agr. Research Inst., Pusa, Sci. Rpts., 1921–22, pp. 28, 29*).—A continuation of studies by Mukherji on the carbon dioxid content of grassed and cultivated soils is reported, the results confirming the results of Warth (E. S. R., 47, p. 515).

The soil atmosphere of the grassed plat was uniformly much richer in carbon dioxid than that of the cultivated crop, and this difference was most marked during the monsoon months. It was also found that the very great increase in the carbon dioxid content of the grassed plats during the monsoon months is associated with fairly high temperatures and heavy rainfall, and is due to the decomposition of the organic detritus introduced into the soil from the grass roots.

Phosphoric acid in cane juices, H. WALKER (*Indus. and Engin. Chem., 15 (1923), No. 2, pp. 164, 165; also in La. Planter, 70 (1923), No. 7, pp. 127, 128*).—Studies on the relation between the phosphoric acid content in sugar cane juices and the requirement of the soil for available phosphoric acid are reported.

It was found that the juices from fields nearest sea level were rather high in phosphoric acid, those from the central portion up to about 500 ft. elevation were moderately well supplied, and those from the highest areas showed the lowest phosphoric acid content. This tendency was so uniform that in the case of the fields thus far examined it was possible, with the aid of a contour map, to predict roughly the amount of phosphoric acid to be expected in the juice from any field.

It was also found that in a general way the phosphoric acid content of the juice was proportional to that dissolved from the soil by a 1 per cent solution of citric acid. It is considered quite possible that cane juices will always contain a certain minimum amount of phosphoric acid, and that its lack in the soil will be followed by lower cane yields rather than by a further diminution of phosphoric acid in the juice. It is thought, however, that, while a juice analysis alone may not definitely indicate the requirement of a soil for phosphatic fertilizer, a relatively high content of phosphoric acid in the juice will very probably indicate that such fertilization is not needed, and thus by elimination assist in the location of field experiments where they are more necessary.

Acidity of plant roots and soil lime, G. Masoni (*Staz. Sper. Agr. Ital., 53 (1920), No. 12, pp. 421–437*).—Studies on the action of the juices of different plants when in contact with calcareous soil and an excess of pure calcium carbonate are reported which showed that these juices maintained an acid reaction several days after such contact. This occurred with juices tested immediately after extraction as well as with juices permitted to ferment. Partial or total sterilization retarded the neutralization of the acid remaining free in contact with the lime. When fresh or fermented juices were heated to boiling with calcareous soil or with pure calcium carbonate, an acid reaction was maintained with the soil which persisted for some days. With the pure calcium carbonate there was a decreasing indication of acidity which, however, was never totally neutralized except in the case of the fresh juice of beets.

Further studies of the action of solutions of several organic acids and acid salts thereof in varying concentrations when in contact with calcareous soil and pure calcium carbonate showed that they were rapidly neutralized whether hot or cold. On the other hand, hot or cold solutions of monopotassium phosphate and monocalcium phosphate in concentrations corresponding to those of the organic acids and salts used maintained an acid reaction for several days when in contact with these soils. When in contact with pure calcium carbonate in cold solutions, a more selective neutralization took place. Rapid neutralization took place after boiling. Proteins, amids, and sugars eventually present in vegetable juices did not interfere with the reaction between acids and lime.

Comparative manurial value of the whole plants and the different parts of green manures, N. V. Joshi (*Agr. Research Inst., Pusa, Bul. 141 (1922), pp. 14*).—This is a continuation of studies previously reported (E. S. R., 42, p. 18), the purpose being to determine whether the assumed relation between crop yields and accumulation of nitrates holds good and also whether the results obtained under laboratory conditions are borne out by field trials.

The results indicate that the application of leaves alone of all the plants used as green manures gave throughout a very high yield of oats, thus fully confirming the conclusion arrived at independently from nitrification studies in the laboratory. With one exception the yields of oats resulting from burying the whole plant in the soil were actually lower than those obtained by adding leaves alone. This is taken to indicate that the further addition of organic matter in the forms of stems and roots has an injurious effect on the yield. Even where the yield secured by the addition of the whole plants was equal to that obtained by adding the leaves alone, no additional benefit derived from the application of extra organic matter in this form could be observed. The direct addition to the soil of the stems and roots of green manure plants was also found to be injurious to crops grown subsequently. These results as a whole are taken to indicate that since the leaves alone are valuable for immediate use as manure and are quickly nitrified, green manures could be allowed to grow a little longer than is permitted at present, so as to obtain a larger quantity of leaves.

Green manuring experiments [at the Ganji Bar Experimental Station], P. E. Lander (*Punjab Dept. Agr. Rpt., 1921, pt. 2, pp. 38, 39*).—The results of three years of green manuring experiments are said to indicate that the increases in the yield of the treated plats are in accordance with the amount of green manure buried.

The composition of some sheep manures, G. E. Colby (*Calif. Dept. Agr. Mo. Bul., 10 (1921), No. 1, pp. 47, 48*).—Analyses of 17 samples of sheep manure from northern and southern California are presented and discussed.

These showed that the water content varies from 7.07 to 11 per cent, the organic matter from 46.43 to 55.22, and the mineral matter from 35 to 47 per cent. The phosphoric acid content varies from 14.4 to 26.6 lbs. per ton, the potash from 32.6 to 48, and the nitrogen from 25.2 to 30.6 lbs. per ton. It is stated that such weights of phosphoric acid as sheep manure yields would hardly compare with that held by any ordinary commercial fertilizer.

Comparative efficiency of fish meal plants, D. B. Dill (*Amer. Fert., 58 (1923), No. 7, pp. 25–28*).—A report is presented of studies aimed to compare efficiencies of operation in the production of tuna fish meal by the common types of plants in southern California canneries. It is shown that, as at present operated in the manufacture of tuna fish meal, the continuous plant loses almost three times as much nitrogen per unit of fish meal as the hydraulic plant. This was found by determining the weight of scrap required per unit of fish meal produced, as well as the composition of the scrap and the final products.

The composition of the fish meal in itself gave little or no clue to the efficiency of the plant, and it is stated that no reliance can be placed on such figures so far as nitrogen conservation is concerned.

A new source of manure, K. Adinarayan Rao (*Agr. Jour. India, 17 (1922), No. 5, pp. 476–482*).—Studies of the manurial value of megasse, the waste material after the extraction of juice from sugar cane, are reported. Prior to bacterial treatment the megasse was found to contain only 0.027 per cent of nitrogen. After bacterization for a period of only two months the nitrogen content increased to 1.39 per cent, which is said to be twice as much as is contained in barnyard manure.

The effect of fertilizers on germination and seedling growth, M. E. Sherwin (*Jour. Amer. Soc. Agron., 15 (1923), No. 2, pp. 66–73*).—The results of studies conducted at the North Carolina Experiment Station on the germination of corn and cotton seeds in different types of soil, either with the seeds in direct contact with various fertilizers or with the same fertilizers mixed with the soil in which the seeds are planted, are reported.

The results appeared to indicate clearly that germination is generally inhibited by the presence of fertilizers, this inhibition being greater when the fertilizer is in direct contact with the seed than when mixed with the soil. The amount of inhibition was found to be generally proportional to the amount of fertilizer used, and was greater with the more soluble mineral fertilizers than with the less soluble mineral or the organic materials. The inhibiting action is apparently not due to a direct effect of the fertilizers upon the viability of the seed, but to a retarding influence upon the osmotic absorption of water from the soil by the seed in the case of the soluble mineral fertilizers, or to the stimulation of the growth of fungi, especially molds, which are injurious to the root systems of the young seedlings, by the presence of organic fertilizers like cottonseed meal. Borax in amounts as small as 3.5 lbs. per acre exerted a marked inhibiting effect upon root growth, which was not counteracted by the addition of ferrous sulphate in solution.

The relative nitrifiability of different nitrogenous organic manures in some typical soils of the Central Provinces and Berar, F. J. Plymen and D. V. Bal (*Agr. Jour. India, 17 (1922), No. 6, pp. 551–559*).—In a continuation of studies previously noted (E. S. R., 41, p. 816), experiments to determine the response to nitrification of some common organic manures in five typical soils widely found in the Central Provinces and Berar and subject to varying conditions of climate and cultivation are reported.

The nitrogen of castor cake appeared, generally, to be quickly available, and karanja and sarson cakes were not much inferior to castor cake in this respect except in lateritic soil containing a considerable proportion of stones and

gravel. Linseed and tili cakes were next in order of merit. Mahua refuse appeared to be a relatively slow acting manure. Peanut cake did not seem to undergo a rapid decomposition in some soils, but in black cotton soil 86 per cent of its total nitrogen content was nitrified in eight weeks. The nitrogen of mahua cake was not nitrified to any appreciable extent during a period of eight weeks in any of the soils. Results obtained on a light yellow soil consisting chiefly of fine sand, a typical rice soil where the cultivation is of an anaerobic or semianaerobic nature for a considerable period of the year, showed that the nitrifying power was much less than that of soils subject to open cultivation.

Matsap pan: A potential source of nitrates, A. W. Rogers (*So. African Jour. Indus., 6 (1923), No. 2, pp. 73–80, fig. 1*).—This is a brief report of a geologic investigation of so-called Matsap pan in the Union of South Africa, which appears to be a potential source of nitrate. Analyses of a few samples are presented and discussed, indicating that the brine contains an amount of nitrates which might be economically recoverable if the supply of brine is large enough. The supply has not as yet been ascertained.

The story of sulphate of ammonia (*Amer. Fert., 58 (1923), No. 5, pp. 25–32, figs. 6*).—This is a general article covering the geographic distribution of ammonium sulphate, sources of production, and the more important production processes. Some of the results of its experimental use in agriculture are also briefly summarized.

The nitrogen action of hexamethylentetramin on plant production, E. Blanck, W. Geilmann, and F. Giesecke (*Jour. Landw., 70 (1922), No. 4, pp. 221–251*).—Studies conducted at the University of Göttingen are reported which show that hexamethylentetramin, as a condensation product of the mixture of ammonium and formaldehyde, or resulting from the treatment of liquid manure with formalin to conserve the nitrogen, is as good a source of nitrogen for the nutrition of such crops as oats, mustard, and beets under normal conditions as is ammonium sulphate. This was found to be true in spite of the complicated organic composition of the hexamethylentetramin. The transformation of the organic nitrogen content of hexamethylentetramin was found to occur under the influence of bacteria in the customary manner, resulting in the formation of ammonia which is very rapidly changed into the nitrate form.

Researches on the comparative availabilities of phosphatic fertilizers, A. Demolon and P. Boischot (*Compt. Rend. Acad. Agr. France, 9 (1923), No. 10, pp. 316–321; also in Compt. Rend. Acad. Sci. [Paris], 176 (1923), No. 11, pp. 777–779*).—Studies of the availability of a number of phosphatic fertilizers are briefly summarized, indicating that the presence of calcium carbonate in soil has a tendency to decrease the solubility of phosphates, especially the natural phosphates. A marked action from natural phosphates seems to have been obtained only in soils deficient in calcium carbonate.

A comparison of the values of flour phosphates with those of bone meal, H. H. Wiles (*Indian Tea Assoc., Sci. Dept. Quart. Jour., 1922, No. 3, pp. 108–111*).—Comparative experiments with bone meal and a flour phosphate on cowpeas are briefly described. The flour phosphate was a calcium phosphate containing 56 per cent of lime, 26 per cent total phosphoric acid, and 6 per cent phosphoric acid soluble in citric acid.

The bone meal was found to contain the higher percentage of rapidly available phosphates in spite of its less finely divided state. The flour phosphate, however, had a greater residual action and could be more evenly applied.

Availability of the Trichinopoly phosphatic nodule as a manure for paddy, M. R. Ramaswami Sivan (*Agr. Jour. India, 17 (1922), No. 6, pp. 560–563.*

pl. 1).—Studies of the availability of Trichinopoly phosphate as a source of phosphoric acid for paddy cultivation are briefly reported. These indicate that mineral phosphate ground as finely as possible is a suitable phosphatic fertilizer for paddy lands when applied with decomposing organic matter. The residual effect of the mineral phosphate is apparently quite marked.

Mineral resources of the United States, 1919.—II, Nonmetals, R. W. STONE (*U. S. Geol. Survey, Min. Resources U. S., 1919, pt. 2, pp. IV+565, figs. 23*).—This report contains special articles on peat, potash, gypsum, phosphate rock, and lime.

Uses of gypsum in agriculture, O. LOEW (*Deut. Landw. Presse, 49 (1922), Nos. 74, pp. 480, 481; 75, pp. 485, 486; 76, pp. 493, 494*).—The results of several experiments, conducted under the supervision of the author at the Agricultural Institute of Tokyo, Japan, on the use of gypsum in agriculture, particularly as an alkali-reducing fertilizer, are summarized. These showed in every case that gypsum had a favorable influence where the availability of phosphoric acid had been reduced by the use of physiologically alkaline fertilization, whether the phosphoric acid was added as bone meal, dicalcium phosphate, or sodium phosphate. Crop yields were increased, especially where gypsum was used with sodium nitrate.

The removal of an alkaline reaction was more favorably effected by gypsum than by the use of physiologically acid fertilizers. Gypsum was ineffective when used with acid fertilizers. It was further found that insufficient gypsum is formed by the use of potassium sulphate. It is also concluded that gypsum makes soil iron more available to plants.

A note on the use of anhydrite as a remedy for black alkali, G. E. COLBY (*Calif. Dept. Agr. Mo. Bul., 10 (1921), No. 1, pp. 39–41*).—Experiments on the use of anhydrite or calcium sulphate on soils impregnated with black alkali as compared with gypsum are briefly reported. These showed that the actions of anhydrite and gypsum on black alkali in moist soils are approximately the same. The conclusion is drawn that anhydrite possesses the same value as a chemical remedy for black alkali as gypsum or land plaster.

Proceedings of the nineteenth annual convention of the National Lime Association (*Natl. Lime Assoc. Proc., 19 (1921), pp. 90, figs. 11*).—These proceedings include, among other special articles, a report from the Tennessee Experiment Station on Getting Facts about Lime in the Soil, by W. H. MacIntire.

Report of the bureau of feeds and fertilizers on agricultural lime and limestone, B. W. SEBRING (*Ohio Dept. Agr., Bur. Feeds and Fert. Spring Rpt., 1921, pp. 131–138*).—This report contains actual analyses and guaranties of 27 samples of limes and limestones collected for inspection in Ohio during the spring of 1921.

Report of the bureau of feeds and fertilizers on commercial fertilizers, B. W. SEBRING (*Ohio Dept. Agr., Bur. Feeds and Fert. Spring Rpt., 1921, pp. 101–129*).—This report contains special articles on fertilizers by F. E. Bear and R. D. Scott, and presents the results of actual analyses and guaranties of 214 samples of fertilizers and fertilizer materials collected for inspection in Ohio during the spring of 1921.

Report on commercial fertilizers, 1922, E. H. JENKINS and E. M. BAILEY (*Connecticut State Sta. Bul. 241 (1922), pp. 55–144*).—This bulletin contains a list of brands of fertilizers registered for sale in Connecticut for the year 1922, together with actual analyses and guaranties of 837 samples of fertilizers and fertilizer materials collected for inspection in the State during 1922.

The Fertilizers Act, 1922 (*Ottawa: Canada Dept. Agr., Seed Branch, 1922, pp.* [*13*]).—The text of the fertilizer inspection law of Canada is presented.

AGRICULTURAL BOTANY.

Strasburger's textbook of botany, H. Fitting, L. Jost, H. Schenck, and G. Karsten, trans. by W. H. Lang (*London: Macmillan & Co., Ltd., 1921, 5. ed., rev., pp. XI+799, figs. 833*).—In a short prefatory sketch, the history of this book, particularly the five English editions, is summarized. In the present edition the division on morphology is by Fitting, that on physiology by Jost, that on Thallophyta, Bryophyta, and Pteridophyta by Schenck, and that on Spermatophyta by Karsten. Their names are therefore given as the authors on the title page. This edition has been revised throughout with the fourteenth German edition.

The official plants mentioned under the natural orders are those of the British Pharmacopœia instead of those official in Germany, Switzerland, and Austria, which are given in the original.

A textbook of general bacteriology, E. O. Jordan (*Philadelphia and London: W. B. Saunders Co., 1921, 7. ed., rev., pp. 744, pl. 1, figs. 177*).—The final chapter of the 37 which compose this book is devoted to bacterial diseases of plants, about 12 in number.

Studies in the physiology of the fungi.—XV, Germination of the spores of certain fungi in relation to hydrogen-ion concentration, R. W. Webb (*Ann. Missouri Bot. Gard., 8 (1921), No. 3, pp. 283–341, figs. 39*).—With spores of the eight organisms, *Botrytis cinerea, Aspergillus niger, Penicillium cyclopium, P. italicum, Lenzites sepiaria, Puccinia graminis, Fusarium* sp., and *Colletotrichum gossypii,* a comparatve study has been made on the effects of the H- and OH-ion concentration upon germination in solutions of mannite, peptone, Czapek full nutrient, sugar beet decoction, "water H_3PO_4 and NaOH," and "water HCl or KOH." This supplements previous work (E. S. R., 49, p. 26).

Germination is a process which is strikingly supported by conditions of active acidity. Relatively low percentages of germination, in most cases, are obtained under conditions of active alkalinity, and nutrition exerts a pronounced influence upon the relations of spore germination to the reaction of the medium.

Successively increasing concentrations of H ions in the various culture solutions, from neutrality to approximately pH 3 or 4, influence favorably the germination of the spores of *B. cinerea, A. niger, Penicillium cyclopium, P. italicum, Puccinia graminis, L. sepiaria* and *Fusarium* sp. Moreover, *Fusarium* sp. germinates equally as well, if not better, with an alkaline reaction, and *C. gossypii* is the only species which favorably responds only to an alkaline reaction.

The majority of the fungi employed exhibit a distinct maximum of germination between pH 3 and 4. Certain forms, notably *Fusarium* sp., exhibits a secondary maximum at or near pH 7.

The range of germination and the magnitude of the germination quantities, as influenced by the H-ion concentration, depend upon both the organism and the medium.

Not until a H-ion concentration of pH 1.5–2.5 is reached is inhibition of germination evidenced. The limits on the acid side are comparatively narrow and constant. Those on the alkaline side are very diverse, varying with the organism and with the medium.

Nutrition is an extremely important factor in the germination of fungus spores. In mannite, Czapek, and peptone solutions, the relations of germina-

tion to H-ion concentration are more or less comparable for each particular organism; in beet decoction and water HCl or KOH, on the other hand, results differing decidedly from those furnished by the previously mentioned solutions are obtained.

Mycelial growth and development in the most acid and alkaline cultures permitting germination are relatively more feeble and scant, as determined visually, than in cultures possessing greater departures from the inhibiting concentrations.

Comparing equal concentrations of H and OH ions, the OH ions appear to be relatively more toxic to the spores studied than the H ions. The toxicity of H ions is fairly independent of the other conditions studied, while that of the OH ions tends to be more or less variable or antagonizable, according to the composition of the medium.

A change in reaction of the medium may or may not occur during germination, and, where shifts in the H-ion concentration do occur, the magnitude and nature of these depend upon the fungus, the medium, and the initial reaction.

Various additions of sugar beet decoction to solutions of mannite pronouncedly stimulate germination with the two organisms under experimentation, namely, *A. niger* and *B. cinerea*.

It would seem, therefore, that germination in the beet decoction is stimulated by some special substance or peculiar set of conditions, either or both of which are totally or partially absent in the synthetic culture media.

The data here developed and presented, it is felt, are sufficient to change materially the previously prevailing view concerning the relation of germination of fungus spores to acid and alkaline media, as well as to be of fundamental importance in any future study of fungicides or spray mixtures.

The utilization of organic substances by mold fungi in the absence of oxygen, S. Kostyschew and M. Afanassjewa (*Jahrb. Wiss. Bot., 60 (1921), No. 4, pp. 628–650*).—It is shown that cultures of *Aspergillus niger* on glycerin, mannite, and lactic acid or quinic acid contain zymase and produce ethyl alcohol on exclusion of oxygen, but only in case the nutritive medium is neutral in reaction, even weak acidity limiting alcohol production.

Peptone cultures of *A. niger* are zymase free and produce no alcohol in the absence of air, even if sugar is added. It is assumed that respiration involving sugar and that involving nitrogen represent different processes.

Sugar cultures of *A. niger* utilize in the absence of oxygen considerable sugar without corresponding alcohol production. The same is true of *Penicillium glaucum*. Alcohol is formed by these fungi only in solutions of neutral reaction. In this case the alcohol yield is only one-tenth that with *A. niger*, though it is much greater in case of Penicillium on bread.

The influence of the selenium when substituted for the sulphuric ion in the Knop nutritive solution, M. Awschalom (*Rev. Facult. Agron. La Plata, 3. ser., 14 (1921), No. 3, pp. 122–162, figs. 10*).—In the Knop formula ($Ca(NO_3)_2$, 100; K_2HPO_4, 25; KNO_3, 25; $MgSO_4$, 25; $FeSO_4$, 5; and $MnSO_4$, 5 parts in 100,000 of water) the author substituted in the same or different proportions for the last three $Mg(NO_3)_2$, $Fe(NO_3)_3$, and $MnCl_2$, adding different very small proportions of Na_2SeO_3. The resulting media were used to grow different plants. The effect of selenium was tested also with different lower organisms. Sodium selenite appears to be toxic to higher plants, stopping growth in strengths of 10 to 30 per 100,000 and causing in lower concentrations, in case of legumes, abnormalities which are indicated.

Antiseptic effects are noted in some detail in connection with disease-producing organisms.

The toxic action of arsenic, antimony, and fluorin compounds on some cultivated plants, A. Wöber (*Angew. Bot., 2 (1920), No. 6, pp. 161–178*).—In view of the fact that smelter emanations contain certain toxic substances, tests were made regarding the degrees of toxicity of some of the more common. It proved impracticable to establish for phanerogams a generally fatal dosage of any poison, tested plants varying widely as regards susceptibility in this respect. Most susceptible to poisons are certain legumes, after these barley, oats, wheat, maize, and rye. Particulars are given regarding the specific effects and corresponding dosage so far as demonstrated.

The physics of transpiration, H. Sierp and K. L. Noack (*Jahrb. Wiss. Bot., 60 (1921), No. 4, pp. 459–498, figs. 4*).—The purpose of this work is to give usable mathematical expression to each and to any and all combined of the factors concerned in transpiration from plant surfaces.

Note on curvature of cut stems of Bryophyllum calycinum, P. F. Fyson and K. Venkataraman (*Jour. Indian Bot., 1 (1920), No. 9–10, pp. 337–343, pls. 2*).—Experiments made to determine whether special root-forming and curvature-producing substances could be recognized as being formed in the leaves, as assumed by Loeb as the result of his various observations on *B. calycinum*, repeated those of Loeb, with certain modifications to eliminate the effects of weight. The authors found no evidence in support of the theory of special curvature-producing hormones or of root-forming substances. On the other hand, their observations confirmed the views regarding the effect of an excess of water on adventitious root formation.

A further series of experiments on the effect of the growth of an axillary bud on the development of the marginal leaf notches failed to confirm Loeb's results. All differences in the rate and amount of growth of roots and shoots from the margins of the leaf can, according to their view, be sufficiently explained by the suction naturally produced, by a developing organ, on the water and sap locally available, without the assumption of any special inhibitory action. Development of the marginal notches was found to be induced readily by an excess of water which appeared to be the sole determining cause. Their observations entirely negatived Loeb's supposition of an inhibitory effect of root pressure on this development.

Critical studies on Blackman's theory of limiting factors in carbon dioxid assimilation, R. Harder (*Jahrb. Wiss. Bot., 60 (1921), No. 4, pp. 531–571, figs. 9*).—The law, credited primarily to Blackman as referred to in publications previously noted (E. S. R., 24, p. 533; 25, p. 220), and here so quoted as to state that when a process is conditioned as to its rapidity by a number of separate factors the rate of the process is limited by the pace of the slowest factor, has been tested by systematic studies here detailed. The conclusion is that the Blackman theory of limiting factors does not hold, at least for light intensity and carbon dioxid concentration as affecting velocity of assimiliation in submerged water plants tested.

Periodicity of bud development, I. Luyten and M. C. Versluys (*Meded. Landbouwhoogesch. [Wageningen], 22 (1921), No. 1, pp. 128, pls. 9, figs. 25*).—Periodicity studies more or less related to these have been referred to by Blaauw (E. S. R., 43, p. 729), and besides the evident importance of such studies for their bearing upon experimental morphological investigations, it has become apparent that they are of value also in connection with studies of teratological and pathological deviations. In order to understand clearly what influences may have worked upon the abnormally strong growth of some organs it is necessary to know the normal time of their origination and development. The present study (summarized in English) aims at the acquire-

ment of such knowledge, and the results are detailed of studies on *Rhododendron catawbiense*, *Azalea mollis*×*A. chinensis*, and *Syringa vulgaris*.

The growth of tree twigs, C. A. LUDWIG (*Ind. Acad. Sci. Proc., 1921, pp. 121–131, figs. 6*).—During the summer of 1921 the author made a series of measurements on growing tree twigs, bearing upon the nature of plants and of growth, but most specifically upon the question whether in the absence of irrigation reliable data can be secured in humid regions for determining the normal course of the growth rate.

The trees used were *Prunus persica* and *Cornus florida*, the number, and consequently the data, being very limited. A growth rate initially slow increased to a maximum and later dropped to zero before the lowering temperature again reached the point at which spring growth started. Growth rate change was interfered with by lack of available moisture in at least part of the trees, so that irrigation appears necessary. Shading and changes in the relative lengths of day and night are thought to be influential in the course of the cycle. The dogwood is not advantaged by shade, but is shade enduring and food storing. In branches growing at an angle the terminal shoot of dogwood grows less than any of the closely spaced laterals which start growth at the same time. The lowermost (outermost) branch grows the most and becomes the future leader.

Plant indicators, J. M. MURRAY (*Roy. Scot. Arbor. Soc. Trans., 36 (1922), pt. 1, pp. 52–57*).—In view of the economic necessity of eliminating as many as possible of the various subclimaxes that would normally have to exist before reaching the desirable forest climax formation, a certain amount of attention has been given to those conditions which favor the growth of the subclimax stage and to the ways in which they affect such growth.

A general table is given showing briefly the conditions under which various plants used as indicators may be found, and also the species of tree which are usually planted under such conditions. This table, confessedly incomplete, is offered more as a basis for observations and for discussion than as a universal guide.

[Heridity], F. R. SAUNDERS (*Brit. Assoc. Adv. Sci. Rpt., 88 (1920), pp. 169–190, figs. 4*).—A review (dealing mainly with the present century) of the development of knowledge bearing upon the inheritance of characters by organisms culminates in an appeal for more organized cooperation in the experimental study of genetics.

Mutations in Nicotiana sylvestris, R. SAVELLI (*Ann. Bot. [Rome], 15 (1922), No. 4, pp. 197–263, figs. 54*).—Floral anomalies of *N. sylvestris* are described as possibly comprising a case of what has been called mass mutation.

Variegation in certain cultivated plants, M. BALASUBRAMANYAM (*Jour. Indian Bot., 1 (1920), No. 9–10, pp. 325–329, pl. 1, figs. 7*).—Examination of variegated leaves of commonly cultivated plants in Madras shows that very frequently there are in the leaf not two kinds of mesophyll tissue as usually stated but three, and that since the chlorophyll may be present or absent these appear to be fundamentally distinct. Though in most plants examined the middle layer was not found to be white unless one of the other two layers was, in Dracaena the middle layer was found to be white in circular patches, the rest showing green.

Inventory of seeds and plants imported by the Office of Foreign Seed and Plant Introduction during the period from April 1 to May 31, 1920 (*U. S. Dept. Agr. Bur. Plant Indus. Inventory No. 63 (1923), pp. 99, pls. 4*).—Descriptive notes are given of 851 lots of seeds and plants imported during the period April 1 to May 31, 1920.

FIELD CROPS.

[Report of field crops work in Montana], C. McKee, E. Burke, F. M. Harrington, et al. (*Montana Sta. Rpt. 1921, pp. 26–28, 29–32, 45, 58–61, 78–81, 83–87, figs. 11*).—The progress of previous work (E. S. R., 46, p. 327) is reported.

Prominent among the varieties tested were Montana 36 (Kharkof), Kanred, and Station Red winter wheat; Hard Federation and White Federation hard white spring wheat; Preston and Marquis hard red spring wheat; Kubanka and Peliss durum wheat; Trebi barley; Early Mountain, Victory, and Golden Rain oats; Rustler White and Northwestern Dent corn; Triumph, Gehu, and Longfellow flint corn; and Japanese millet.

Early seedings and 30-in. rows with hills 4 to 8 in. apart have given highest yields with sunflowers. Results so far show that sunflowers, pound for pound, draw about as heavily as other crops upon the soil nitrogen, less than grain upon the phosphorus, and more than any other crop upon the potassium. However, the greater acre production of sunflowers under favorable conditions makes them the most exhaustive upon the supply of available plant foods.

Data on winter wheat are cited as fairly typical of the results secured in 11 years on the dry bench land at Fort Ellis. Plowing summer fallow 4, 6, and 8 in. deep resulted in practically no advantage for any one depth, although the 8-in. slightly outyielded the 4-in. plowing. Winter wheat grown continuously averaged 21.1 bu. per acre; in a rotation of corn, peas, fallow, and winter wheat 37.7 bu., and alternating with fallow 37.2 bu. Slightly decreased yields followed the use of manure with alternate fallow and winter wheat.

Methods of potato seed selection have been discussed earlier (E. S. R., 43, pp. 46, 531; 44, p. 38). Early Ohio, Irish Cobbler, and Early Triumph groups of early potatoes are indicated of the greatest value in Montana, and the most important groups of late potatoes are Rural New Yorker, Green Mountain, and Burbank, with Russet Burbank decidedly foremost, particularly under irrigation.

In further work with irrigated crops at the Huntley Substation by D. Hansen in cooperation with the U. S. Department of Agriculture (E. S. R., 46, p. 724), oats following beets averaged 78.6 bu. per acre; after potatoes, 70 bu.; after wheat, 48.4 bu.; and following oats, 33.9 bu. Potatoes following alfalfa averaged 298.2 bu. per acre; after beets, 213.7 bu.; and following oats, 193.3 bu. Sugar beets following alfalfa yielded 14.49 tons per acre, and after potatoes 14.08 tons. Beets averaged 11.25 tons per acre in rotations in which oats (manured) precede beets as compared with 7.56 tons in rotations where unmanured oats precede beets. Calico and Payne White Dent corn outyielded Northwestern Dent for silage.

A very dry season resulted in crop yields considerably lower than the average in dry farm experiments at Huntley by A. E. Seamans. The yields of winter and spring wheat, oats, barley, flax, and corn under various cultural conditions and in rotations supplement the averages noted earlier (E. S. R., 46, p. 724). The great advantage of summer fallowing land was shown in the reasonably satisfactory grain yields.

At the Judith Basin Substation, A. Osenbrug found that winter wheat seeded on native sod land, broken in 1920, did not suffer from winterkilling and averaged 43 bu. of grain per acre, whereas winter wheat totally winterkilled when seeded under the same conditions on land under cultivation for some years, suggesting that the cause of soil drifting and winterkilling in recent years is not due so much to changed climatic conditions as to the altered physical condition of the soil under cultivation. Winter wheat seeded with a

furrow drill outyielded that seeded with an ordinary grain drill by an average of 6 bu. per acre in 1920 and 8 bu. in 1921. On plats unprotected by straw during the winter, winter wheat furrow drilled made about 21 bu. per acre in 1921, or double that on the ordinary drill seeding. For spring wheat spring plowing gave from 7 to 9 bu. more per acre than fall plowing, for oats 13 bu. more, and for barley 9 bu. more. The beneficial effect of residual manure upon the yields of oats and wheat seeded on corn land manured the previous spring was greatly in excess of that recorded previously. Direct application of the manure to oats produced a slight beneficial effect upon the oats and succeeding crops in 1921, but when applied directly to corn the yield of field-cured fodder was heavily increased and the beneficial effect upon the succeeding crop was very marked. Karmont (Kharkof 1583–30) winter wheat and Hard Federation spring wheat were outstanding in variety tests. Sweet clover seeded alone averaged about 0.5 ton of hay per acre more than when seeded with a nurse crop. During the past 6 years alfalfa has averaged about 0.25 ton less than sweet clover.

According to G. Morgan at the North Montana Substation, on fallow, disked corn land, and continuous cropping the respective average acre yields of spring wheat have been 10.4, 8.7, and 4.9 bu.; oats, 20.1, 14.5, and 11.8 bu.; barley, 14.8, 9.4, and 6.8 bu.; and winter wheat, 8.2, 5.9, and 2.3 bu. Corn after fallow yielded 3,782 lbs. total weight, while on spring plowing corn after corn made 3,120 lbs. Horn barley, Peliss and Galgalos wheat, and Swedish Select oats led the varieties. Alfalfa made its highest yield in a 5-year distance-of-cultivation test with rows 4 ft. apart. Sunflowers yielded more heavily than corn for silage, but corn led on the air-dry basis. Brome grass, slender wheat grass, and crested wheat grass were the most promising domestic grasses.

The testing, multiplication, and distribution of new forms of farm crops ([*Cambridge, Eng.*]: *Natl. Inst. Agr. Bot., pp. 12*).—Regulations governing the conduct of the trials and the multiplication and distribution of stocks of cereals are set forth.

Influence of choice of seed on the yield of cereals, F. Boeuf (*Dir. Gén. Agr., Com., et Colon.* [*Tunis*], *Bul., 26 (1922), No. 110, pp. 479–494*).—Experiments in Tunis since 1907 involving the selection of seed of cereals according to size or weight showed such practices to possess rather limited advantages, aside from the elimination of weed seed and broken grain. Improved local varieties and better cultural methods are thought far more important.

Scarification as it affects longevity of alfalfa seed, L. F. Graber (*Jour. Amer. Soc. Agron., 14 (1922), No. 8, pp. 298–302*).—Although scarification was effective for the improvement of immediate germination in studies at the Wisconsin Experiment Station, it appeared to have a deleterious influence on the longevity of alfalfa seed. Where legume seed is to be stored for more than one year, it is evidently prudent to delay scarification until a few months before seeding.

Some observations on the inheritance of awns and hoods in barley, C. E. Saunders and G. G. Moe (*Roy. Soc. Canada Proc. and Trans., 3. ser., 16 (1922), Sect. V, pp. 15–26, pls. 6*).—The behavior of hybrids between Arlington barley (E. S. R., 25, p. 440) and other sorts is claimed to prove the existence of a well-defined, heterozygous type of six-row barley, intermediate as to awns between the fully awned condition and the Arlington type.

There are awnless types of six-row barley in which hoods are practically absent, but which must be classed as potentially hooded because they fail to produce awned descendents and because an occasional trace of an abortive hood can be found among their progeny, either normally on the glume or on one of the basal bracts. The six-row condition in barley is shown to be some-

times almost completely dominant over the two-row state in the heterozygous plants. The six-row sorts showing abortive hoods on the median rows are considered almost ideal in regard to absence of awns, and even if the brittleness of the spikes would prevent their culture for grain they would perhaps be useful for hay.

Self-fertility in red clover, E. N. Fergus (*Kentucky Sta. Circ. 29 (1922), pp. 19–36*).—When 153 seeds obtained from 32 of about 650 artificially self-pollinated red clover plants were planted, they produced 79 normal plants, which in turn were self-pollinated when coming into bloom. The average number of seed produced by self-pollination per normal F_1 plant was 13.1, per self-pollinated head 2.2, and per seed-yielding head 9.

In general, the progeny from the parent plants yielding the larger number of seeds under self-pollination produced large numbers of seeds themselves when self-pollinated, while the reverse was noted with the progeny from parents bearing few seeds. Of 79 normal F_1 plants, 8 yielded seed from every head treated and 42 produced no seed from any head treated even when the number of heads was quite large. Besides these observations, the production of abnormal seedlings, particularly those chlorophyll-deficient in the F_1, and the marked similarity existing among members of certain F_1 groups of sibs, are cited to indicate that self-fertile lines exist in red clover.

Cotton in the current literature of [Egypt and] the world (*Egypt Min. Agr., Cotton Research Bd. Ann. Rpt., 2 (1921), pp. 83–176*).—Summaries are given of current official and other publications relating to cotton in Egypt (pp. 83–95) and throughout the world (pp. 97–176).

Summary of botanical work on cotton carried out in Egypt up to 1918, A. T. McKillop et al. (*Egypt Min. Agr., Cotton Research Bd. Ann. Rpt., 2 (1921), pp. 177–183*).—Papers omitted from the list noted earlier (E. S. R., 46, p. 230) are summarized.

Experimental work on cotton, 1921, A. T. McKillop et al. (*Egypt Min. Agr., Cotton Research Bd. Ann. Rpt., 2 (1921), pp. 19–56, pls. 7*).—Abbreviated accounts (E. S. R., 46, p. 230) describe experimental work conducted under the Cotton Research Board during 1921.

A preliminary study of the demand for various types of Indian cotton, B. C. Burt ([*Indian Cent. Cotton Com., Bombay*] *Bul. 1 (1922), pp. 21, pls. 9*).—An attempt is made to group Indian cottons according to the counts at which they are suitable for spinning. India consumes normally in her own mills more than half of the average commercial crop.

About 50 per cent of Indian yarn is of counts of 20s and over, which proportion tends to increase. Cotton production appears adequate to mill requirements for yarns above 22s. Since the exportable margin of Indian cotton is nearly all of the shortest staple, it would be advantageous to both the grower and spinner if this included more fiber suitable for at least 20s.

The rigidity of cotton hairs, F. T. Peirce (*Jour. Textile Inst., 14 (1923), No. 1, pp. T1–17, figs. 12*).—The resistance to twist and the forces involved by the twisting of cotton fibers may be expressed by the couple or twisting force due to one turn per cubic centimeter, termed the rigidity of the fiber and derived in the formula $\Gamma = s^2 . \eta \epsilon$. in which s^2 is the square of the cross section, ϵ the geometrical form, and η the rigidity (the ratio between the tangential force per unit area and the angle of shear it produces.)

The mean values of fiber rigidity, tabulated for cottons ranging from the finest Sea Island to the coarsest Indian, show a large increase with coarseness of the cotton, and are approximately proportional to the inverse square of the staple length. For this reason a higher constant must be used in calcu-

lating the spinning twist for shorter cottons. Random picking from lightly combed seed gives the most satisfactory and representative result of the methods of sampling.

Correlation was found between the rigidity and the ribbon-width, length, and mass of the fibers. The values of these quantities showed that the effective shape of cross section may be considered as a rectangle with semicircular ends, in which the ratio of wall thickness (half the least diameter) to ribbon width (greatest diameter) varies from 0.2 to 0.3, and gives a coefficient of rigidity for the cotton cellulose of about 0.23×10^{11} dynes per square centimeter, one-tenth that of glass. The values of fiber weight agree with those of length and rigidity, in showing that fibers of all kinds have an approximately constant volume of cellulose which is independent of staple length but varies with growth conditions.

The statics of a newly spun yarn and the value of the geometrical constant $\epsilon=\Gamma/\eta s^2$ are also considered.

The efficacy of a centrifuge for removing surface liquids from cotton hairs, H. F. Coward and L. Spencer (*Jour. Textile Inst., 14 (1923), No. 1, pp. T28–32, fig. 1*).—Experiments with a specially designed centrifuge in comparing the rates of removal of various liquids from cotton and from glass wool fibers indicate that a few minutes' centrifuging with a centrifugal acceleration 2,000 times that of gravity suffices to reduce interfibrillar liquid to 5 or 10 per cent of the weight of the fibers, except with extremely viscous liquids such as castor oil. Since in the above conditions cotton retains water and caustic soda solutions of about 50 and 300 per cent of its weight, respectively, these liquids are held within the body of the cotton fibers to substantially the weights of liquid retained after centrifuging.

The growing and harvesting of flax in Kenya, W. G. Scott and G. M. Hamilton (*Kenya Colony Dept. Agr. Bul. 9 (1921), pp. 10, pls. 4*).—Cultural and harvesting practices are outlined. The superiority of Kabete Dutch Child flax and of the practice of dew retting is shown.

Hemp breeding, C. Fruwirth (*Ztschr. Pflanzenzücht., 8 (1922), No. 4, pp. 340–401, figs. 3*).—Studies supplementing earlier work (E. S. R., 17, p. 456) are reported, with comment on the technique of hemp breeding.

Although seed of unimproved hemp varies in color and size, with a single exception the dark color predominated in the lots of seed of European origin studied. Light colored seed was lower in weight and germination than the darker seed both in bulk and in selections. The color and size of seed are uniform within a plant from commercial stock as well as in a selection, when unripe and sterile seed and mutations are eliminated.

Crossing plants of a dark breed with those from a light line was not accompanied by xenia. While inbreeding in both lines was followed by reduced stalk and fruit yields, the plant height and life duration apparently were not effected and malformations were the exception. Sexual association of plants in both strains produced in F_1 increases in the stalk weight and the seed yield of the individual plant.

The kapok industry, M. M. Saleeby (*Philippine Bur. Agr. Bul. 26, rev. ed., (1922), pp. 42, pl. 11, figs. 4*).—The characteristics, origin, distribution, and adaptation of kapok (*Ceiba pentandra*) are discussed, with cultural methods and practices for preparing and marketing the fiber in the Philippines and Java. Extension of the industry in the Philippine Islands is deemed justifiable.

Studies on the effect of nitrogen applied to oats at different periods of growth, W. F. Gericke (*Jour. Amer. Soc. Agron., 14 (1922), No. 8, pp. 312–320*).—An amplified account of results obtained with the Texas Red oats noted earlier (E. S. R., 48, p. 529).

The relative physiological status of oat plants, expressed by differences in age and grown under the conditions described, appears to be an important factor affecting the quantity and quality of product obtainable from a given unit application of nitrogen. This factor can probably be mathematically expressed and evaluated. The marked and consistent differences in the response from equal applications of nitrogen as sodium nitrate and as ammonium sulphate are thought to be due to differences in the physiological properties of the salts. Results from similar experiments with other cereals confirm these conclusions.

A new classification of side oats, DENAIFFE, COLLE, and SIRODOT (*Jour. Agr. Prat., n. ser., 39 (1923), No. 6, pp. 111, 112*).—A revision of the classification of *Avena sativa orientalis* included in an earlier work (E. S. R., 15, p. 575).

Field peas, G. R. HYSLOP (*Oregon Sta. Circ. 34 (1923), pp. 2*).—Concise directions for the production of field peas in Oregon, embracing adaptation, uses, soil treatment, time, method and rate of planting, harvest methods, and threshing precautions.

A preliminary test of stored cut seed potato stock, K. C. WESTOVER (*Amer. Soc. Hort. Sci. Proc., 19 (1922), pp. 86–87*).—Seed stock cut in storage (38–42° F.) at about two-week intervals from October 17, 1921, to April 24, 1922, was compared at the West Virginia Experiment Station with uncut tubers added at different times during the storage period. The cut lots lost weight quite rapidly for the first 100 days, while checks lost the most within the first few days of storage. Cut stock lost from two to four times as much as the checks, according to the length of the storage period. Marked wilting and discoloration and lack of vigor in fall plantings was observed only in the two cut lots longest in storage. Although variations in the amounts of large and small tubers were not apparent, longer storage periods generally gave greater yield differences.

The application of genetic principles to potato breeding, F. A. KRANTZ (*Amer. Soc. Hort. Sci. Proc., 19 (1922), pp. 124–129*).—Seed collected from F_1 seedlings of Sir Walter Raleigh × an unnamed South American variety gave rise to F_2 populations at the Minnesota Experiment Station in 1913 and in 1921 and 1922. Although the parents were heterozygous for tuber color, by selecting white tuber seedlings in F_1 a large F_2 population of this character was obtained, enabling selection for other desirable qualities. Results on tuber shapes agreed with those of Salaman (E. S. R., 24, p. 632), indicating that shape depends essentially on the presence or absence of a single factor for length. Both early and late-maturing seedlings were obtained in F_2. Although "the heterozygous condition of the parent varieties complicates the combining of the desirable characters of the parent varieties into a commercial variety, it does not prevent such combinations from being obtained if sufficiently large populations can be grown."

Report on the sugar cane experiments for the season 1920–1922, J. R. BOVELL and J. P. D'ALBUQUERQUE (*Barbados Dept. Agr., Rpt. Sugar-Cane Expts., 1920–1922, pp. 67*).—Varietal and fertilizer trials with sugar cane (E. S. R., 46, p. 534) are described for the season indicated. Insect attack again rendered fertilizer studies inconclusive.

Cuttings from large clumps of B. H. 10(12) produced 19,512 canes per acre weighing 27.1 tons, as compared with 17,189 canes and 24.2 tons from small clump cuttings.

The leading varieties of plant canes in plat tests in the black-soil districts included B. 183, B. 199, B. 263, Ba. 12079, and Ba. 11569, with from 7,665 to 6,385 lbs. of sucrose per acre, and in the red soils B. 67, Ba. 11569, B. H. 10(12), Ba. 12079, and Ba. 632, with from 7,241 to 6,463 lbs. of sucrose per

acre. First among selected varieties on black soils for the period 1918–1922 were B. 39, B. H. 10(12), and B. 18, with 7,318, 7,066, and 6,898 lbs. of sucrose per acre, respectively. Selected varieties, plant cane, for the seasons 1915–1917 to 1920–1922 on red soil were led by B. H. 10(12), Ba. 11569, and Ba. 1279.

When grown in the same fields and under similar conditions during the interval from 1912–1914 to 1920–1922, B. H. 10(12) produced average increases of 59.9 per cent over White Transparent and 26.8 per cent over B. 6450. The respective increases made by other new varieties over the two standards were 48.8 and 13.4 per cent with Ba. 6032, 34.5 and 7.9 with Ba. 7924, and 57.3 and 21.2 per cent with Ba. 11569.

The effects of self-fertilization in timothy, H. K. HAYES and H. D. BARKER (*Jour. Amer. Soc. Agron., 14 (1922), No. 8, pp. 289–293*).—Self-fertilized clonal lines of timothy studied at the Minnesota Experiment Station varied widely in the amount of seed set, probably due to genetic causes, as marked similarity was noted between the percentages of seed obtained from a clonal line in the greenhouse and in isolated field plats. Some albino seedlings were found among the progeny of 5 out of 11 first-year self-fertilized strains.

Experiments with dark tobacco and other crops, B. G. ANDERSON (*Virginia Sta. Bul. 231 (1923), pp. 19, figs. 5*).—Rotations and fertilizer, liming and cultural practices are recommended on the basis of experiments with dark tobacco and other crops on Cecil sandy loam and Cecil clay soils in Appomattox County, Va.

The experiments and observations recommend for the dark tobacco grower a 3 or 4 year rotation in which tobacco, small grain, and clover or clover and mixed grasses are included. The comparative results of fertilizer tests conducted on soils below the average in productivity for tobacco indicate that within the experimental limits the higher rates of fertilization were accompanied by the greater profits. Evidence as to the best source of nitrogen for tobacco is not thought conclusive, and the choice will be governed somewhat by the cost of the materials. On soils with adequate organic matter application of from 500 to 800 lbs. of 16 per cent acid phosphate per acre, with relatively liberal amounts of nitrogen and potash, is suggested. Striking differences were not observed between the sulphate and the muriate of potash as sources of potassium. The application of lime resulted in enhanced yields of tobacco, corn, and alfalfa.

Varieties outstanding or with highest yields included Lizard Tail and Little Dick tobacco, Fulcaster and Fultz wheat, New Era and Groit cowpeas for grain, and Brabham, Black, and Whippoorwill cowpeas for hay, Virginia soy beans, Grimm and Baltic alfalfa, and Green Mountain selections and Irish Cobbler potatoes. The grain yields of corn varieties ranged from 22 to 31.3 bu. per acre.

The cultivated wheats, DENAIFFE, COLLE, and SIRODOT (*Les blés cultivés. Paris: [Authors], 2. ed., rev. and enl., pp. 151, figs. 165*).—Part 1 of this book outlines a method termed stachymetry and designed for the improvement and identification of wheat varieties. The procedure, which embraces modifications of Ohlmer's method, gives diagrammatic outlines of the front and profile of typical spikes of the variety. A synoptic key to the varieties grown in France is included, together with descriptions, illustrations, and spike diagrams of 77 varieties. The second part comprises a morphological study of the wheat spike with a table of new characters for differentiating the principal cultivated species.

Use of water by spring wheat on the Great Plains, J. S. COLE and O. R. MATHEWS (*U. S. Dept. Agr. Bul. 1004 (1923), pp. 34, figs. 10*).—The measurement of the rate of use and the quantities of water used under the conditions

surrounding the wheat crop in the field is attempted on the basis of data obtained with durum wheat at field stations throughout the Great Plains in the period 1907 to 1920, inclusive. Type curves showing the rate of use for the entire season are presented for representative years and localities. The importance of the problem is discussed by E. C. Chilcott in a brief introduction.

The daily rate of use of water by a wheat crop depends upon climatic environment and the quantity of vegetation composing the crop. The rate of use of water by a unit quantity of crop is primarily dependent upon geographical location and secondarily upon seasonal conditions, but within the limits that they overlap, either one or the other may dominate.

The normal rate of the use of water by the wheat crop during its period of rapid growth has averaged from about 0.15 to about 0.2 in. per day at stations in the northern Great Plains, the rate depending upon the quantity of crop as influenced by cultural practices. This rate is increased from 50 to 60 per cent at stations in the southern Great Plains, varying from 0.24 to 0.3 in. at Amarillo, Tex.

The total consumption of water by the crop is highly correlated with the yield produced by it. A high yield requires a high use of water, but, on the other hand, a high use of water may not necessarily result in a high yield, because of failure of the water supply near the end of the growing season, or because other unfavorable conditions may prevent the realization of the potential yield.

For any locality within the Great Plains the data indicate that the relation between the yield and the water consumed during the growth of the crop is a linear one, but the origin of the line is not zero, since the consumption of a certain minimum quantity is necessary before any yield above zero is obtained. Each unit increase of water consumed above this minimum appears to result in a unit increment of yield. Both the minimum quantity required and the quantity required for each unit increment of yield depend upon the climatic environment of the season and on the average upon the geographical location. The minimum quantity of water necessary to the harvest of any grain has ranged from about 4 in. at the northern stations to 10 in. at the southern stations. Tentative formulas are presented for Edgeley, N. Dak., and North Platte, Nebr., by which to calculate the yield from the water consumption. Each bushel of yield at Edgeley requires 0.2 in. of water above the minimum, and each bushel yield at North Platte requires 0.4 in. above the minimum.

From the quantity of available water in the soil and the daily rate of use and the time needed to mature the crop, or the total quantity of water required for a given production, the probable yield from a given precipitation during the remainder of the growing season or the precipitation needed to produce a given yield can be calculated. While this method of forecasting yields has obvious limitations, it is thought to afford a better basis of approximation than has been available heretofore.

The best wheats from the viewpoint of yield and baking qualities, SCHRIBAUX (*Vie Agr. et Rurale, 22 (1923), No. 10, pp. 157–161*).—Baking tests at Paris by Arpin and Pécaud with wheat of the 1921 crop show Manitoba de l'Isère and Japhet spring wheats and Hybrid Inversable (Vilmorin), Gironde Inversable No. 12 (Camille Benoist), and Rieti early winter wheats outstanding in baking qualities. Late winter wheats, including Wilhelmina, Double Walcorn, Cuirassier de Svalöf, and Australian poulard, were among the poorest. They contained 4.53, 5.49, 7.02, and 7.38 per cent of gluten, respectively, as compared with 9.45 per cent in Hybrid Inversable and 15.84 per cent in Manitoba. The author proposes to create by hybridization and selection wheat varieties both productive and of good milling and baking value.

The control of wild morning-glory, C. C. BARNUM (*California Sta. Circ. 256 (923), pp. 22, figs. 13*).—The distribution of wild morning-glory (*Convolvulus arvensis*) in California is indicated, and control methods are outlined. Experiments by Gray on the chemical control of the weed have been noted (E. S. R., 41, p. 537; 42, p. 823).

Thorough and frequent deep cutting below the surface at intervals not longer than five days during the growing season may eradicate the weed in one year. The green leaves must not reach the surface. A good stand of alfalfa may kill out morning-glory in two to three years. Treatment with salt brine is recommended for untilled land, and with carbon bisulphid for small patches of the weed. Smothering with inert material was not effective, and commercial weed killers and the general use of sodium arsenite are not advised.

Control of bindweed (*Union So. Africa Dept. Agr. Jour., 6 (1923), No. 3, pp. 206–210, figs. 7*).—Alfalfa planted on infested land at Grootfontein, Middelburg (Cape), produced good yields and smothered *Convolvulus arvensis.*

HORTICULTURE.

[Horticultural investigations at the Montana Station], F. M. HARRINGTON, H. THORNBER, and G. MORGAN (*Montana Sta. Rpt. 1921, pp. 61–65, 71–77, 88, 89, figs. 6*).—Selected home-grown strains of tomatoes produced larger yields than did varieties obtained from reliable seed houses. Of sweet-corn varieties tested, the Assiniboine, Nuetta, and Early June were most satisfactory on account of early maturity. The Golden Bantam was rather inconsistent in its behavior. The Columbian Mammoth White asparagus is deemed especially valuable for the higher altitudes of the State. Very satisfactory yields of cucumbers were obtained even without the aid of irrigation. Squashes usually matured satisfactorily, but are not considered a sure crop. The Great Northern field bean proved exceptionally satisfactory.

With the exception of the Flathead and Bitter Root Valleys, successful strawberry culture is largely dependent upon proper winter mulching, which serves to prevent winterkilling and to delay blossoming until after the early spring frosts. Of varieties tested, the Progressive everbearing and the Senator Dunlap standard have given the most satisfaction. Raspberries—red, purple, and black—may be grown if the canes are laid down in the fall and covered with earth. Certain varieties of currants and gooseberries have proved sufficiently hardy to endure the adverse winter conditions.

Tillage and cover crop studies with the apple at the Montana Horticultural Substation at Victor are again discussed (E. S. R., 47, p. 832). The results strongly emphasize the value of cover crops. In fact, long-continued clean culture seriously injured the trees and materially reduced yields. However, in the early life of the young trees potatoes proved a better intercrop than did clover, which tended to retard growth and reduce production. Peas were not as satisfactory as clover as a cover crop, in that the greater amount of irrigation required apparently resulted in a rapid apple growth which was very susceptible to fire blight.

Variety tests with sweet corn at Victor showed Peep o' Day, Golden Bantam, White Cob Cory, and Early Minnesota to be the most satisfactory varieties for the Bitter Root Valley. Corn and bean seed produced in the valley proved much superior both in earliness and productivity to that brought in from outside sources. The De Soto and Hanska plums and the Golden Winesap and Cortland apples showed promise. Thinning tests carried out with several apple varieties indicated the value of this practice with those varieties naturally inclined to produce a large amount of small fruits.

Shelter-belt planting conducted at the substation at Havre in cooperation with the U. S. Department of Agriculture showed that the box elder, American elm, green ash, and Northwest poplar may, with proper care, be carried successfully through extremely dry seasons. Plantings in the spring of 1921 of white spruce and jack and yellow pines showed respective survivals of 84, 39.6, and 34.6 per cent in the fall of the same year.

Rate of planting garden beans, M. C. GILLIS (*Market Growers Jour., 32 (1923), No. 8, p. 24*).—The largest yields of Red Valentine, Burpee Stringless Green Pod, and Refugee garden beans, thinned to 2, 3, and 6 plants to the running foot of row, were obtained where there were 6 plants. The yields in pounds per acre of green beans for the varieties, arranged as above, were as follows: (1) 2 plants per foot, 7,396, 7,305, and 8,831; (2) 3 plants per foot, 8,728, 8,717, and 9,687; and (3) 6 plants per foot, 9,567, 9,352, and 10,197.

Self-sterility in the Chinese cabbage, Y. KAKIZAKI (*Jour. Heredity, 13 (1922), No. 8, pp. 374–376, fig. 1*).—As a result of pollinating flowers of the Chinese or Pe-tsai cabbage in five different ways, (1) enclosing blooms in paraffin sacks, (2) pollination with pollen of the same flower, (3) pollination with pollen from other flowers in the same inflorescence, (4) pollination with pollen from different inflorescences on the same plant, and (5) pollination with pollen from other plants, the following respective yields of normal pods were obtained, 4.8 per cent, 30.3, 23.4, 35.3, and 96 per cent. In the fourth group the individuals ranged all the way from complete sterility to complete fertility, indicating the existence of self-compatible strains. In some plants better success was obtained between crosses of flowers on different inflorescences than between those on a single inflorescence. The results conform in part with those of Detjen with ordinary cabbage (E. S. R., 48, p. 634).

Time of flower primordia formation in the onion (Allium cepa), H. A. JONES and V. R. BOSWELL (*Amer. Soc. Hort. Sci. Proc., 19 (1922), pp. 144–147*).—A microscopical examination of Yellow Globe Danvers onions at different stages in their life showed that under the conditions obtaining at College Park, Md., the flower primordia are differentiated early in the spring of the second year from seed, irrespective of whether the bulbs were planted out in the autumn or held in storage and set out in early spring. No apparent correlation was found between the stage of vegetative development and the time flower primordia were differentiated. Fall planted bulbs, which made a luxuriant foliage development before the differentiation of flower primordia, produced uniformly taller and heavier seed stalks, carrying a heavier set of blossoms than did spring-planted bulbs.

Head lettuce in Colorado, R. A. MCGINTY (*Colorado Sta. Bul. 283 (1923), pp. 3–26, figs. 9*).—Information is presented relative to the growing, harvesting, and marketing of head lettuce in Colorado, where it has been recently found that a very high-grade product can be grown in the valleys located at high altitudes. The very rapid expansion of the industry from a modest beginning in 1918 to approximately 547 cars in 1922 has presented many cultural and marketing problems, which are briefly discussed in the text. The New York variety, incorrectly known as Mountain Iceberg, has proved the most satisfactory for the high altitude.

Isolation of uniform types of Hubbard squash by inbreeding, J. W. BUSHNELL (*Amer. Soc. Hort. Sci. Proc., 19 (1922), pp. 139–144*).—Self-pollination studies conducted at the Minnesota Experiment Station with Hubbard squash, a variety which has shown itself to be peculiarly variable in such fruit characters as size, shape, color, thickness of the edible portion, keeping and eating quality, etc., have led to the production of several valuable strains, one of which, the Kitchenette Hubbard, is being distributed as a commercial

variety. Of 17 inbred strains tested in 1919 in comparison with commercial stocks, 12 had a coefficient of variability of less than 20 per cent. In respect to yield, 6 four-generation inbred lines averaged 11.6 kg. (25.5 lbs.) per plant, as compared with 12.3 for the 6 commercial lots. The author concludes that uniform high-quality strains of squash of desirable economic types may be obtained by inbreeding, and suggests the applicability of this form of breeding as a possible means of improving other vegetable species.

Effects of certain physiological factors on blossom drop and yield of tomatoes, W. A. RADSPINNER (*Amer. Soc. Hort. Sci. Proc., 19 (1922), pp. 71–82*).—Studies conducted at the Oklahoma Experiment Station intermittently since 1910 to determine the cause of abscission of tomato blossoms have led to various explanations, such as insufficient soil and air moisture, imperfect pollination, high temperatures, nutritional defects, etc.

One of the earlier workers, N. O. Booth, obtained a 41 per cent increase in yield and an 18 per cent increase in the number of fruits as a result of irrigation. F. B. Cross failed to secure increases from irrigation, but obtained larger yields following the application of straw mulch, and with the aid of overhead irrigation and shading increased the yield per plant from 4.5 lbs. for nonshaded, irrigated plants to 14.75 lbs. for shaded and irrigated plants.

In 1922 the author, working in a well-ventilated greenhouse with June Pink and Yellow Pear tomatoes to which were applied various nutrients and various amounts of water, found that the water supply is a very important factor in influencing the dropping of blossoms. Increased soil moisture resulted in an increase of fruits set, in larger size of fruit and plants, in higher moisture content of leaves, and in the decrease in percentage of ash. Extremely high temperature and low humidity caused blossoms to drop, probably by increasing transpiration. With other factors constant, the blossoms dropped more rapidly when relative humidity was low. Fertility of the soil had a minor effect on the abscission of blossoms. It is concluded that genetic factors are not concerned.

[Spray calendars for New Jersey fruits], T. J. HEADLEE, W. H. MARTIN, and A. J. FARLEY (*New Jersey Stas. Circs. 147 (1923), pp. 4, fig. 1; 148, pp. 4, figs. 3; 149, pp. 4, figs. 3; 150, pp. 4, fig. 1; 151, pp. 3, fig. 1*).—This series of spray calendars for the apple and quince, peach, pear, plum and cherry, and grape is designed to supersede similar previously noted pamphlets (E. S. R., 47, p. 140).

An experiment in ringing apple trees, J. K. SHAW (*Amer. Soc. Hort. Sci. Proc., 19 (1922), pp. 216–220*).—The early spring ringing of 7-year-old Wagener, Wealthy, and Oldenburg trees, planted 10 by 10 ft., stimulated fruit bud formation in those trees carrying a light crop or no fruit. The ringing of fruitful trees, on the other hand, failed to stimulate fruit bud formation for the successive season, but did not materially injure the trees. The Wagener variety apparently responded more favorably to ringing treatment than did the other two. Midsummer ringing, July 15 and August 1, failed to result in satisfactory healing, did not stimulate fruit bud formation, and inhibited both growth and fruit production. Where marked stimulation of fruit bud formation followed ringing, an on-year of blooming was established which continued in alternate years until interfered with by some environmental factor.

The yield and growth measurements of the various trees are given in tabular form.

Carbohydrate reserves of young apple trees as influenced by winter storage condition, P. T. BLOOD (*Amer. Soc. Hort. Sci. Proc., 19 (1922), pp. 33–35*).—In order to determine what carbohydrate reserves of young nursery apple trees are lost during the winter storage period, fall and spring analyses were made to determine the free reducing sugars, sucrose, starch, and acid

hydrolyzable material in the roots, branches, and trunks of 3-year-old Gravenstein trees, part of which were fall planted in the field, part stored in a cellar ranging between 30 and 40° F., and part stored in another cellar ranging from 45 to 50°.

The results, presented partly in tabular form, show the total carbohydrates, including hydrolyzable material, to be approximately equal in the autumn in the trunks, branches, and roots. However, the roots contained about 25 per cent less reducing sugar and three times as much starch as did the trunks and branches. Spring analyses showed marked reduction in total carbohydrates in all three lots of trees. Sucrose was then practically absent in the branches and trunks, with little change in the roots. Notable decreases in starch occurred in every part of all the trees, but were greatest in warm-stored trees, where the losses amounted to 75 per cent in the branches, 70 per cent in the trunk, and 43 per cent in the roots. In concluding, the author points out that considerable losses occur under conditions apparently promoting dormancy, and suggests that ideal storage should be such as to keep trees from respiring and using stored materials.

Detecting the misnamed apple tree, J. K. Shaw (*Country Gent., 87 (1922), No. 37, pp. 5, 38, figs. 4*).—A popularization of material presented in a previously noted bulletin (E. S. R., 47, p. 641).

Whitney and seedlings from Whitney crosses, C. S. Crandall (*Amer. Soc. Hort. Sci. Proc., 19 (1922), pp. 98–107*).—The use of Whitney as ovule parent in eight crosses with standard varieties, crabs, and a hybrid form resulted in seedling progenies, which are described in detail in this paper in relation to vigor, character of growth, height of trees, fruit characters, etc. One of the eight crosses, namely Whitney×*Pyrus* (*Malus*) *baccata maxima*, failed to produce fruit.

Crosses in which Whitney was used as pollen parent, including seven on standard varieties and six on crablike forms, are also discussed in relation to sets of fruit obtained and the character of the resulting seedlings. Certain of the F_1 seedlings of the earlier crosses pollinated with Whitney have yielded seedlings which closely resemble the F_1 individuals in form.

Sterility relationships in Maine apple varieties, K. Sax (*Maine Sta. Bul. 307 (1922), pp. 61–76, fig. 1*).—Further studies at the Highmoor Farm on apple pollination (E. S. R., 43, p. 645) confirm an earlier conclusion, namely, that for all practical purposes all important commercial apple varieties grown in Maine are self-sterile. Furthermore, it was found that certain well-known varieties are intersterile. In compatibility tests with six varieties, Baldwin, Ben Davis, Golden Russet, Rhode Island Greening, McIntosh, and Northern Spy, it was found that combinations involving the use of Baldwin or Rhode Island Greening as pollen parent are generally unsatisfactory. With these exceptions all other combinations were interfertile.

Finding that emasculated and depetaled apple blossoms rarely set fruit, even when left uncovered, the author practiced this method in 1921 and 1922, thereby enabling himself to make a much larger number of crosses than was hitherto possible. Furthermore, it was found that the removal of all but one blossom from each flower cluster resulted in a more uniform set of fruit.

Notwithstanding the fact that few honeybees were able to visit the Ben Davis orchard in the spring of 1921 on account of the cold, windy weather prevailing during the entire period of blooming, a satisfactory set of fruit was secured, leading the author to conclude that natural insects such as bumble, leaf cutter, and mining bees are able to pollinate Maine orchards provided there is a moderate number of early blooming varieties or natural

trees in the vicinity. However, honeybees are deemed desirable to insure adequate sets of fruit, and under some conditions may probably be indispensable. Practical recommendations applicable to the orchardist are offered.

Effect of defoliation upon blossom bud formation: American plum species, R. H. ROBERTS (*Wisconsin Sta. Research Bul. 56 (1923), pp. 15, figs. 5*).—This is a report of investigations in which were studied the effect of removing foliage upon the succeeding fruit bud and spur development.

In 1917 the removal on July 13 of leaves from the alternate nodes of current season shoots of seedling plums resulted in the entire absence of fruit bud formation at the stripped nodes. However, the later in the season the leaves were removed, the less was the inhibiting effect, until on August 24 defoliation merely resulted in a decrease in the size of fruit buds. The measurements of 53 spurs developing from defoliated nodes showed an average length of 26.17 mm., as compared with 100.16 mm. for 55 spurs from normal nodes. In repetitions of the experiments in 1918, 1919, and 1920, in which not only the whole but different quantitative fractions of the leaves were removed, no total inhibition of fruit bud formation was obtained.

Cutting the midrib transversely near the base of the blade had a definite reducing effect upon bud development. The removal of one-half the leaf by a cut parallel to the midrib had practically the same inhibiting influence as cutting off the apical half of the leaf. It is believed that the reduced length and size of spurs developing from defoliated nodes are due primarily to a reduction in the nitrogen reserve, since determinations of total nitrogen in the buds and basal wood at defoliated and normal nodes showed on April 12 0.81 per cent for defoliated and 1.43 per cent for normal nodes.

The recovery of grapevines when the young shoots are killed by spring frosts, E. ANGELO (*Amer. Soc. Hort. Sci. Proc., 19 (1922), pp. 29–32*).—Moderate yields of fruit were obtained in 1922 from 6-year-old Catawba, Concord, Moore Early, and Niagara vines, the shoots of which were killed back when about 10 in. long. Inasmuch as the vines comprised a training experiment in which the four-cane Kniffin, horizontal arm spur, fan, and high renewal systems were compared, opportunity was offered to ascertain the relation of the type of training to recovery. Vines trained according to the horizontal arm spur system produced more new shoots, more blossom clusters, and more fruit than did those of any of the other systems. The superiority of the horizontal arm spur training is believed due to the fact that a larger number of basal buds remained dormant until after the freeze. These buds would not have, in all probability, produced shoots during a normal season. The largest average yield, 1.12 lbs. per vine for the horizontal arm spur system of training, is believed to have been approximately 8 per cent of normal production.

The Madaleine Angevine grape, D. CASELLA (*Italia Agr., 59 (1922), No. 11, pp. 389–391, pl. 1, figs. 2*).—The pollen of this desirable vinifera grape variety is described as abortive, necessitating interplanting with a good pollinating variety. For this purpose the seedling Aramon×Rupestris Gaz. 1 has been very successful.

Brazilian fruits and the centennial, P. H. ROLFS (*Fla. Grower, 27 (1923), No. 16, pp. 4, 5, figs. 4*).—Several species of tropical and subtropical fruits are discussed in a popular way and comments made on their possible adaptation to culture in Florida.

Variations in pecans, F. W. BRISON (*Jour. Heredity, 13 (1922), No. 8, pp. 366–368, fig. 1*).—Observations upon the nuts of 36 pecan trees, all grown from seed obtained from the original San Saba mother tree, showed a wide range in variability in size and form of nuts. Of four of the seedlings deemed to be as good as or better than the parent, two have been introduced under the

names Texas Prolific and Western Schley. Since the pecan may be propagated by grafting and budding, it is thought that the growing of seedlings should be practiced only as a means of developing new varieties.

Oil palms and their fruit, A. A. L. Rutgers, E. Leplae, and P. Tingey (*London: Griffiths & Co., Ltd., 1922, pp. VI+41*).—A collection of three papers discussing the present status of the oil palm producing industry.

Discovery of the ancestral form of Dahlia juarezii, W. E. Safford (*Jour. Heredity, 13 (1922), No. 8, pp. 377–381, figs. 3*).—A paper relating to the origin of the dahlia, and pointing out that the double form was cultivated by the ancient Aztecs.

Sterility in lilies, A. B. Stout (*Jour. Heredity, 13 (1922), No. 8, pp. 369–373, figs. 3*).—Pollination studies conducted at the New York Botanical Garden with many species of lilies showed that a large number are completely self- and generally cross-incompatible. That this condition is not due to physical imperfections of the floral organs was shown in several instances, e. g., *Lilium croceum*, which after failing for 8 years to set seed from various self- and cross-pollinations, developed fine large pods containing many viable seed when fertilized with the pollen of *L. elegans*. Attempts to fertiize *L. tigrinum* with pollen of *L. canadense*, *L. supurbum*, *L. henryi*, *L. speciosum*, *L. auratum*, and *L. humboldtii* were fruitless, but when pollen of *L. maximowiczii* was used fine pods containing fertile seed were readily obtained. The type of sterility noted is described as that of physiological incompatibility in fertilization. Variation within a species was observed in a case of *L. regale*, where of 10 plants tested for self-compatibility only 1 developed seed.

That there are other types of sterility in lilies was shown in the instance of *L. batemanniae*, where the spores both in the pistils and the stamens were found to be aborted and functionless in any relation. A one-sided abortion characteristic of intersex was noted in at least one species.

The author states that the Easter, Madonna, Henry, lance-leaved, and regal lilies may be readily grown from seed, and that seedlings may frequently flower in the second year. Bulb formation does not in the least affect seed production, which, except in rare cases, depends upon the growing of self- or cross-compatible strains.

FORESTRY.

Tree planting in the Great Plains region, F. R. Johnson and F. E. Cobb (*U. S. Dept. Agr., Farmers' Bul. 1312 (1923), pp. II+33, figs. 18*).—Following an introductory statement in which is emphasized the value of shelter belt plantings for the wind-swept area known as the Great Plains, general directions are given for the establishment of such plantings, including plant materials, location of plantations, source of stock, preparation of soil, time of planting, methods of planting, and care of plantations. A large proportion of past failures is believed due to neglect on the part of the grower himself. It is believed that with thorough preparation of the soil, spring planting, and thorough culture during the early life of the plantation, shelter belts may be established under the most difficult conditions. Cattle, rodents, insects, and fires must necessarily be excluded.

Note on weights of seeds, S. H. Howard ([*Indian*] *Forest Bul. 41 (1920), pp. 9*).—A tabular presentation giving the approximate number of seeds per ounce for 171 species of Indian trees.

Delayed germination of forest seeds, H. Puchner (*Forstwiss. Centbl., 44 (1922), No. 12, pp. 445–455*).—Studies conducted with hornbeam and ash seeds showed that piercing the seed coat for the purpose of accelerating germination generally leads to unsatisfactory results, the treated seeds usually decaying

before germination. The drying of ash seeds for six weeks previous to planting apparently delayed initial germination, but had no influence on ultimate germination. Similar tests with ash seeds unremoved from the husks resulted in much lower germination, indicating that the husks are detrimental to satisfactory growth. Linden seeds sown in beds in June, 1914, did not sprout until April of the following year and required 6.75 years to complete germination, which even then was only 14 per cent. Linden seeds in their original husks were extremely resistant to the entrance of soil moisture, untreated seeds showing no germination and pierced seeds only 1 per cent.

Experiments with Scotch pine seeds, E. Hesselink (*Meded. Rijksbosschbouwproefsta. [Utrecht], 1 (1922), No. 1, pp. 9–102, pls. 9, figs. 12*).—Scotch pines grown in Holland from seeds obtained in various parts of Europe showed marked peculiarities according to their source. From the very first the native seedlings surpassed those from foreign countries. Careful examination in the winter of 1920–21, when the trees were 10 years of age, showed that seed from Holland and northern Belgium had given the most satisfactory results, with that from Scotland next.

Certain correlations were noted between the mother trees, the color of seeds, and the progeny. In sowing seeds of various colors, those having black seed coats germinated first, while those with light colored seed coats germinated slowly and irregularly. An examination of strains of trees derived from 60 parent trees gave strong evidence that trees with conical crowns produced black seeds and trees with pyramidal crowns white seeds. Seed produced in favorable seasons contained a larger percentage of dark colored individuals than did that of poorer years. Descendants from trees with conical crowns and with black seed developed tap roots, while descendants of trees with pyramidal crowns and white seed were entirely lacking in this form of root. Trees from brown seeds were intermediary in root form. An examination of 5-year-old trees raised from different colored seeds from the same parent tree showed that those from dark seeds grew more rapidly than those from light colored seeds.

The effect of poultry manures on seed production was shown in the increased germination and a lesser weight per 1,000 seeds, with no difference in the proportion of dark and light seeds. Cones containing light colored seeds were more resistant to opening than those containing dark seeds. Root studies in young pineries which had flourished at first and later declined indicated that this trouble is often due to poor root systems. As a result of poor nutrition the trees fall victim to various diseases. This lack of proper root development is deemed to be hereditary and avoidable by the selection of the right kind of seed.

The forests of New York State, A. B. Recknagel (*New York: Macmillan Co., 1923, pp. XIII+167, pls. 12, fig. 1*).—This book, dealing with the economic aspects of forests and potential woodlands in New York State, emphasizes the very important part the forests have played in industrial development, and points out the vital relationship of intelligent forest conservation with the welfare of the people.

First biennial report [of the] forestry division for the period commencing December 18, 1920, and ending October 31, 1922, T. S. Goodyear, V. O. Wallace, and G. C. Joy (*Wash. State Forestry Div. Bien. Rpt., 1 (1921–22), pp. 28, pls. 4, fig. 1*).—Similar to the final annual reports (E. S. R., 44, p. 641), this contains information regarding expenditure of funds, fire protection activities, management of State forests, etc. The hazard following the very severe windstorm in the Olympic Peninsula necessitated a large amount of extra work, the details of which are discussed.

Report of the superintendent of forestry, C. S. JUDD (*Hawaii Bd. Commrs. Agr. and Forestry [Bien.] Rpt., 1921–22, pp. 19–45, pls. 7*).—This review of the work of the division of forestry for the two years ended December 31, 1922, is devoted chiefly to forest protection and extension activities. Efforts were made through the running of accurate surveys and the construction of line fences to protect the watersheds from damage by grazing stock. Two new forest reserves were set aside by proclamation and substantial additions made to existing reserves. Over 37,000 more trees were set out on the forest reserves than during the preceding biennial period (E. S. R., 45, p. 744). The Oahu chaulmoogra oil plantation, consisting of four species obtained by Rock (E. S. R., 47, p. 240), is briefly discussed.

Report of the forest nurseryman, D. HAUGHS (*Hawaii Bd. Commrs. Agr. and Forestry [Bien.] Rpt., 1921–22, pp. 46–51, pls. 2*).—A brief statement concerning the collection and distribution of forest seeds and plants.

Annual reports of the forest administration of Nigeria for the years 1919, 1920, and 1921, H. N. THOMPSON and L. PALFREMAN (*Nigeria Forest Admin., Ann. Rpts., 1919, pp. 20; 1920, pp. 24; 1921, pp. 18*).—The usual reports (E. S. R., 44, p. 240) pertaining to forest inspection, alterations in area, general silvicultural operations, and exploitation activities.

Introduction to the systematy of Indian trees, A. H. CHURCH (*Oxford Bot. Mem. 12 (1921), pp. 50*).—This preliminary classification of Indian forest trees compiled as a basis for student lectures is based largely on flower and fruit characters.

Woods of the Philippine dipterocarps, L. J. REYES (*Philippine Jour. Sci., 22 (1923), No. 3, pp. 291–344, pls. 31*).—This paper presents a detailed enumeration of the gross and minute anatomical features and physical properties of the more important commercial species of Philippine dipterocarps. *Parashorea malaanonan,* one of the largest, most widely distributed, and most valuable species, is discussed in considerable detail in order to serve as a standard of comparison. Magnifications of tangential and cross sections of the wood are shown.

An old friend in new dress: The present uses for Turkish boxwood, and the search for substitutes, S. J. RECORD (*Sci. Amer., 128 (1923), No. 5, pp. 318, 319, figs. 4*).—Wood of the species *Phyllostylon braziliensis,* native of Argentina, Brazil, Cuba, Dominican Republic, and Haiti, is described by the author as the most recent addition to the boxwoods of commerce. Although belonging to the elm family, the wood is finely textured, yellow in color like boxwood, and for several purposes serves as a satisfactory substitute.

Bud grafting of Hevea brasiliensis, G. E. PERRY (*India Rubber World, 68 (1923), No. 2, pp. 483–486, figs. 9*).—Directing attention to the fact that investigations in the East Indies have shown that individual rubber trees vary markedly in their latex-producing capacities and that these variations are probably transmissible through the medium of asexual reproduction, the author discusses the anatomy of the tree, the relation between types and yield, factors in bud selection, and the technique of budding. Drawings of the anatomical structure of the latex-producing tissue are reproduced.

Turpentine and rosin: Distribution of the world's production, trade, and consumption, V. E. GROTLISCH (*U. S. Dept. Agr., Dept. Circ. 258 (1923), pp. 13*).—Based on information gathered from various sources, including consular agents, trade commissioners, miscellaneous publications, etc., approximate estimates are given in tabular form of the production, consumption, and trade in various naval stores for the different countries of the world. Due to the absence of official figures, except for the United States and British India, ab-

solute accuracy was not possible, but the author believes that the data given show, in general, the relative importance of the different countries as sources of turpentine and rosin. The United States not only furnishes from 60 to 65 per cent of the world's turpentine and 70 to 75 per cent of the world's rosin, but also uses more than any other country, consuming roughly between 35 and 40 per cent of the turpentine and 30 per cent of the rosin.

Forest statistics for several countries (*Renseignements de Statistique Forestière Relatifs à Quelques Pays. Rome: Inst. Internatl. Agr., Serv. Statis. Gén., 1922, pp. [3]+120, figs. 2*).—A compilation of statistical data concerning the size, composition, and yield of forests in Canada, Denmark, Finland, France, Great Britain, Greece, Morocco, Norway, Sweden, Netherlands, Switzerland, and Czechoslovakia.

DISEASES OF PLANTS.

Indiana plant diseases, 1919, M. W. GARDNER (*Ind. Acad. Sci. Proc., 1919, pp. 135–156*).—The parasitic fungi of economic importance in Indiana have been previously recorded by Pipal and by Osner (E. S. R., 43, p. 243). While additions to the present list are to be included in subsequent reports, the nature of the report has been altered so that it constitutes a somewhat detailed account of the general crop pathology and the diseases of economic importance during the season. Diseases of forest trees and ornamentals are not included, but diseases not reported in the previous lists are enumerated in the summary.

Indiana plant diseases, 1920, M. W. GARDNER (*Ind. Acad. Sci. Proc., 1920, pp. 187–208, figs. 12*).—In accordance with the plan outlined in the above report, the plant-disease situation in Indiana for the season of 1920 is summarized as completely as reports and observations permit, the economic point of view being maintained.

[Report of the] plant physiological and pathological section, H. MÜLLER-THURGAU and A. OSTERWALDER (*Landw. Jahrb. Schweiz, 36 (1922), No. 6, pp. 808–853*).—This portion of the present report deals with a wide range of phases involving loss or protection from losses connected with bad conditions or plant diseases.

[Plant physiology and diseases], H. MÜLLER-THURGAU, A. OSTERWALDER, and G. TEGEN (*Landw. Jahrb. Schweiz, 36 (1922), No. 6, pp. 774–784*).—The report (covering 1917–1920) of the section for plant physiology and pathology includes abnormal conditions involving loss due to animal pests as well as plant diseases.

[Plant diseases], H. SCHELLENBERG (*Landw. Jahrb. Schweiz, 36 (1922), No. 6, pp. 913, 914*).—These pages deal with false mildew and leaf curl in grapevines as regards control measures.

Diseases and pests of cultivated plants in the Dutch East Indies during 1920, C. J. J. VAN HALL (*Dept. Landb., Nijv. en Handel [Dutch East Indies], Meded. Inst. Plantenziekten, No. 46 (1921), pp. 50*).—A more general agricultural review is followed by a systematic account of diseases and pests of economic plants, alphabetically arranged.

Two new host plants of Bacillus solanacearum, S. C. J. JOCHEMS (*Bul. Deli Proefsta. Medan, No. 13 (1921), pp. 13, pls. 4*).—On the east coast of Sumatra, *Canna glauca*, *C. indica*, and their hybrids are attacked by a soil bacterium which causes a fatal wilt disease. Morphological and physiological studies and cross inoculation on tobacco with several strains show the causal organism to be *B. solanacearum*. These are said to be the first instances known of attack by this organism on monocotyledonous plants.

Cultivated *Impatiens balsamina* is subject to a disease due to the same organism, the plants being stunted but not killed.

The pycnidium of Cicinnobolus, J. M. VAN HOOK (*Ind. Acad. Sci. Proc., 1920, pp. 215, 216, figs. 3*).—The present paper notes very briefly the occurrence of a parasitic Cincinnobolus in the fruiting form in the perithecia only of *Podosphaera oxyacanthae.*

Germination conditions of teleutospores of Uredineae, IV, P. DIETEL (*Centbl. Bakt. [etc.], 2. Abt., 54 (1921), No. 8–10, pp. 215–219*).—In continuation of work previously noted (E. S. R., 34, p. 744), and in view of opinions offered by Klebahn (E. S. R., 31, p. 540), the author has reached the general conclusion that during the winter rest of the teleutospores there is no period of complete uniformity as regards the influence of conditions, but that among the external factors (of which moisture, dryness, and air access are most important), the time element is secondary in causing alterations in the spores, enabling them to germinate. Data obtained recently are detailed with brief discussion.

The Uredinales of Indiana, III, H. S. JACKSON (*Ind. Acad. Sci. Proc., 1920, pp. 165–182*).—The present article, supplementary to the two previously noted (E. S. R., 43, p. 731), includes, besides numerous corrections and additions to previous lists, species new to Indiana numbered 156–167, with a host index.

The Ustilaginales of Indiana, II, H. S. JACKSON (*Ind. Acad. Sci. Proc., 1920, pp. 157–164, fig. 1*).—This paper, the first supplement to the contribution previously noted (E. S. R., 43, p. 329), brings the number of species of Ustilaginales up to 57, giving additional hosts for the species previously noted. An index to species for the two papers is appended, together with a complete host index.

Lime-sulphur fungicides and insecticides, A. BECKERICH (*Prog. Agr. et Vitic. (Ed. l'Est-Centre), 43 (1922), No. 48, pp. 522–526*).—A review is given of chemical and commercial phases of the means available to combat plant pests and diseases, partly with a view to replacing the expensive copper fungicidal component with a cheaper effective controlling factor.

Storage experiments with lime intended for sprays, A. A. RAMSAY (*Agr. Gaz. N. S. Wales, 33 (1922), No. 10, pp. 747–749*).—A series of laboratory trials was commenced in November, 1921, to determine how lime for orchard sprays may be stored with the least deterioration and how to minimize or prevent such loss. The chemical composition, originally and after slaking, is given, as shown by analyses at different periods of lime stored in a kerosene tin or in an earthenware jar.

It was found that during 172 days the calcium carbonate increase (indicating deterioration) was not over 0.3 to 0.4 per cent. It is, therefore, recommended that lime of good quality should be procured and kept under water until required for use. Two methods of procedure are suggested.

Faulty lime in Bordeaux mixture, H. L. MANUEL (*Agr. Gaz. N. S. Wales, 33 (1922), No. 10, p. 759*).—Air-slaked lime (apart from the fact that more is required) is deemed as suitable for making Bordeaux mixture as is quicklime ($CaO+H_2O=CaO_2H_2$).) If it becomes partly or wholly carbonated, as it tends to do when long exposed ($CaO_2H_2+CO_2=CaCO_3+H_2O$), it is rendered less efficient or even harmful, due to the formation in the fungicide of other substances, among these copper carbonate which is injurious to green tissues.

Barley leaf stripe, [W. B. L. VERHOEVEN] (*Verslag. en Meded. Plantenziektenkund. Dienst Wageningen, No. 23 (1921), pp. 18, pls. 4, fig. 1*).—Barley stripe has done much harm since about 1918, but is controlled with 0.75 per cent copper sulphate solution at 3 liters per hectoliter of seed (1 qt. to 0.9 bu.), also with Upsulun, 7 liters per hectoliter, at a strength not under 1 per cent, or (according to preliminary tests) with 4 per cent Germisan at 3 liters per hectoliter.

Wheat rust control through barberry eradication, D. B. SWINGLE (*Montana Sta. Rpt. 1921, pp. 40–42, fig. 1*).—The relation of the barberry to the black stem rust of wheat is pointed out, and an account is given of the campaign carried on in Montana for barberry eradication.

Barberry eradication prevents black rust in western Europe, E. C. STAKMAN (*U. S. Dept. Agr., Dept. Circ. 269 (1923), pp. 15, figs. 3*).—An account is given of a survey made by the author of western Europe to determine the relation of the barberry to the black rust of wheat and the efficiency of barberry eradication for the control of the rust.

Kill the common barberry with chemicals, N. F. THOMPSON (*U. S. Dept. Agr., Dept. Circ. 268 (1923), pp. 4, figs. 3*).—In this circular, prepared in cooperation with the Wisconsin Experiment Station, directions are given for the destruction of the common barberry (*Berberis vulgaris*) by the use of salt or by applications of sodium arsenate solution.

A note on the biology of crown gall fungus of lucern, J. LINE (*Cambridge Phil. Soc. Proc., 20 (1921), No. 3, pp. 360–365, figs. 7*).—An account is given of information said to have been obtained as the result of investigations in progress before the appearance of the detailed reports by Wilson (E. S. R., 44, p. 748) and by Jones and Drechsler (E. S. R., 44, pp. 643, 748). The external features of alfalfa crown gall (*Urophlyctis alfalfae*), the reaction to infection of the host plant, and the development of the fungus and host plants, of which *Medicago sativa* is the only host plant observed to be associated with the fungus in three areas indicated in England, are considered.

Anthracnose of the cucumber under glass, W. F. BEWLEY (*Jour. Min. Agr. [London], 29 (1922), Nos. 5, pp. 469–472; 6, pp. 558–562*).—Anthracnose (*Colletotrichum oligochaetum*) is now regarded as the most important cucumber disease in Great Britain, attacking the young plant near the ground level and causing a shrinkage of the tissues until the plant falls over. It spreads rapidly up the plant and gives rise to spore masses in about five days.

Though fumigation with burning sulphur has not proved efficient, experiments with an emulsion of cresylic acid and soft soap have shown that by properly spraying the spaces and objects devoted to cucumber culture the disease can be practically controlled. Cultural and other control methods are indicated.

The anthracnose organism overwinters in rotten woodwork, timber, paper, etc., in the glasshouses. Straw manure from towns constitutes an important source of infection. The disease may be controlled during the growing season by employing drastic methods of ventilation, or by alternately spraying the plants with liver of sulphur, or lime sulphur and flour paste, and removing the spotted leaves.

Studies on the physiology of Fusarium lini, Y. TOCHINAI (*Sapporo Nat. Hist. Soc. Trans., 8 (1921), No. 1–2, pp. 19–44*).—Of the three fungi named in connection with flax wilt, *Asterocystis radicis*, *Colletotrichum linicolum*, and *F. lini*, the last is said to be the most general and destructive, and this has been made the subject of study as to physiological characters and relations, regarding which a bibliography of 29 titles is given.

On several kinds of the artificial culture medium the fungus develops well, producing conidia and later chlamydospores. In the synthetic solution here used, both tannic acid and citric acid retard the growth of the fungus. In the potato agar medium, citric acid stimulates the growth of the fungus in a low concentration, but retards it in a higher percentage. In the synthetic solution here used, the minimum, optimum, and maximum temperatures for the growth of the fungus are 10 to 12, 30, and 36 to 37° C., respectively. Conidia kept wet at 50° lose their germinability within 2 hours, though wet chlamydospores

and resting mycelium at 60° are not killed within 3 hours. The vitality of the fungus is not impaired at a temperature as low as —21°.

A new ginger disease in Godavari District, S. SUNDARARAMAN (*India Dept. Agr. Mem., Bot. Ser., 11 (1922), No. 9, pp. 209–217, pls. 4*).—A new ginger disease appearing in Amalapur Taluk, Godavari District, is said to be due to a parasitic Vermicularia. The disease is described in connection with the serious injury which it causes, especially during wet weather. Chillies and turmeric were not infected on inoculation. The name *V. zingiberae* is suggested. A comparative study of the Vermicularias on several hosts is to be published later.

Hop canker or growing-off, E. S. SALMON and H. WORMALD (*Jour. Min. Agr. [London], 29 (1922), No. 4, pp. 354–359, pl. 1*).—Studies by the authors for some years on hop canker, which is here discussed, have confirmed the general conclusions arrived at by Percival (E. S. R., 14, p. 261) regarding the causal agency in this connection of *Fusoma parasiticum.*

Relation of environment and other factors to potato wilt caused by Fusarium oxysporum, R. W. Goss (*Nebraska Sta. Research Bul. 23 (1923), pp. 84, figs. 5*).—The results are given of investigations conducted by the author in Michigan, Wisconsin, and Nebraska between 1914 and 1922 to determine the influence of environmental and other factors on the potato wilt caused by *F. oxysporum.*

It is claimed that *F. oxysporum* is a soil saprophyte capable of infecting the potato under conditions favorable for the fungus, and that the development of the disease after infection is accelerated by conditions unfavorable for the host. Three methods of infection are recognized: (1) Infection from the soil through the seed tuber, (2) from the soil through the roots and stem, and (3) infection from the seed tuber.

Tests of growing plants are said to show that the potato is more susceptible to infection during its early growth, and that where the conditions are favorable for the plant the host plant may be infected without the symptoms of the disease occurring. A discoloration of the vascular system of both stem and tubers in the absence of any causal organism was found to take place under conditions of high temperature and low soil moisture.

Soil infection experiments with pure cultures of the organism, in which temperature and soil moisture were controlled, showed a small percentage of infection. The results indicate that temperatures of 18° C. (64.4° F.) and below are unfavorable for the development of the disease, and that the amount of infection increases with increasing soil temperatures. The disease is said to develop most rapidly when the temperatures are too high for vigorous growth of the host plant. A constant low soil moisture is unfavorable for infection, but after plants have become infected a lowering of the soil moisture accelerates the wilting of the plant. In all the experiments with inoculated soil, infection took place through the roots rather than through the seed piece.

Infection from the soil was found to be the prevalent method of infection. It is claimed that only a small percentage of tubers having vascular discoloration contain *F. oxysporum,* and that these tubers do not usually reproduce the disease except under conditions very favorable for this type of infection. Neither vascular discoloration of the tuber nor of the stem is considered a good index of infection, unless these symptoms are found in connection with a wilted plant.

The author claims that controlling the disease by cutting away the discolored portion of the tubers is not practicable, and that while seed tubers showing vascular discoloration usually do not reproduce the disease directly, they do produce weak plants that are easily infected from the soil.

Potato diseases in New Jersey and their control, W. H. MARTIN (*New Jersey Stas. Circ. 146 (1923), pp. 32, figs. 25*).—A description is given of the common diseases of potato known to occur in New Jersey, together with suggested methods for their control.

Sunflower wilt, D. B. SWINGLE (*Montana Sta. Rpt. 1921, pp. 42–44, figs. 2*).—A description is given of a disease of sunflowers which appeared in Montana and which promises to be a serious detriment to the growing of this crop. The disease is said to make its appearance usually when the plants are from 4 to 6 ft. in height, attacking the roots and crowns, and causing the plants to wilt and die. The affected base of the stem is at first nearly black but gradually turns brown and then yellow, and under most conditions the diseased crowns and roots are covered with a dense, white growth of the fungus.

No relation has been found between the incidence of disease and previous cropping, and the fungus causing the disease has seldom been observed on wild plants. One instance is cited in which Canada thistles were attacked.

Laboratory studies have resulted in the isolation of the fungus, which resembles *Sclerotinia libertiana*, but a definite identification of the parasite has not yet been made.

Varieties of swedes resistant to finger-and-toe, T. WHITEHEAD (*Jour. Min. Agr. [London], 29 (1922), No. 4, pp. 362–368*).—With a view to testing the resistance of swede varieties to clubroot under the conditions usually prevalent in North Wales, preliminary trials were laid down on three farms in 1920, in which 11 British varieties were tested along with two Swedish and two Danish kinds. The author states that two varieties have been found which resist clubroot to a marked degree, and in addition keep better and have a higher feeding value than the remainder of the varieties included in the trial.

Tobacco mosaic and its control, F. O. LUGO (*Rev. Agr. Puerto Rico, 10 (1923), No. 1, pp. 11–14*).—Observations during three consecutive years justify the conclusion that the source of tobacco mosaic is in the soil. Three methods of rotation recommended include first year, tobacco; second, sweet potatoes, yautias, or maize; and third, a legume.

[Tobacco mosaic], B. T. PALM (*Bul. Deli Proefsta. Medan, No. 15 (1922), pp. 10*).—An investigation undertaken in the attempt to render visible the infectious agent in tobacco mosaic is described, with results, in this preliminary account in both Dutch and English. The fixative fluids employed were Flemming's mixture in various concentrations, alcohol sublimate (hot), and Zenker's fluid. The coloring matter used was Heidenhain's haematoxylin, eosin, and Loeffler's methylene blue.

In a large number of cells of the mosaic diseased tissue, observation was made of fairly large, more or less peculiarly shaped corpuscles, or very small granules of varying size, both kinds frequently occurring in the same cell, though both are entirely absent in healthy tobacco plants. The larger foreign corpuscles lie either in intimate contact with the nucleus or in its vicinity. They are frequently amoebiform, less frequently round to spherical. Occasionally more than one such corpuscle may be present in a cell.

As regards structure, they are usually reticulate, sometimes almost apparently structureless. One or more hollows resembling vacuoles may occur. In well colored sections granules are to be found more or less regularly. No membrane was noted. On sections colored with haematoxylin these corpuscles show a gray color, though light red with eosin. These corpuscles are said to be visible in uncolored preparations of living material, especially in the numerous hairs on the diseased portions of the leaves, where they show the same appearance as in preparations of fixed organs. In comparison with the

surrounding cell plasm they are denser and more opaque. They do not seem to be automotive, though displaced at times by the plasm movement. Other observations are detailed. The cell nucleus in diseased cells is frequently hypertrophied and may show certain symptoms of degeneracy.

Some diseases of tomato in Porto Rico, B. López Santiago (*Rev. Agr. Puerto Rico, 9 (1922), No. 6, pp. 33–37, figs. 2*).—Among the sources of greatly decreasing profit from gardening in Porto Rico is disease, the causes of which, as here noted, include mosaic infection, *Cladosporium fulvum, Fusarium lycopersici, Bacillus solanacearum,* and nematodes.

Tomato diseases in England, [T. A. C. Schoevers] (*Verslag. en Meded. Plantenziektenkund. Dienst Wageningen, No. 25 (1922), pp. 16*).—This communication reports important details regarding a journey to England in 1921 to study tomato diseases.

Diseases and injuries of tomato, [T. A. C. Schoevers] (*Verslag. en Meded. Plantenziektenkund. Dienst Wageningen, No. 26 (1922), pp. 31, pls. 4*).—The report noted above has been followed up by an account of tomato diseases, which are separately described to include some injuries involving insects.

Some common diseases of the tomato [in South Africa], E. M. Doidge (*Johannesburg: Specialty Press of S. A., Ltd., pp. 24, figs. 11*).—In the present condensed publication brief accounts are given of tomato leaf spot (*Septoria lycopersici*), blossom end rot (*Phytobacter lycopersicum?* and species of Macrosporium, Cladosporium, Fusarium, and Phoma), bacterial wilt (*Bacterium solanacearum*), late blight or downy mildew (*Phytophthora infestans*), early blight or leaf curl (*M. solani*), sleepy disease or wilt (*Fusarium* sp.), ripe rot or anthracnose (*Colletotrichum phomoides*), and fruit rot (*Phoma destructiva*).

Control of fire blight in orchards, W. T. Hunter (*British Columbia Fruit Growers' Assoc. Ann. Rpt., 32 (1921), pp. 50, 51*).—Brief details are given of the year's campaign against orchard fire blight in Okanogan, where it has previously been more injurious. No other way has been found of handling fire blight than by cutting away the infected portions.

On a vascular bacterial disease of the banana in the Dutch East Indies, E. Gäumann (*Dept. Landb., Nijv. en Handel [Dutch East Indies], Meded. Inst. Plantenziekten, No. 48 (1921), pp. 135, pls. 8, figs. 18*).—In this report with English summary, it is stated that this banana bacterial disease was first observed in 1915 near Buitenzorg and indicated by inoculation tests as infectious. Though this disease has little economic significance in Java, it was studied more closely as an introduction to the study of a disease of the bananas in Celebes, as described by Rijks in 1916 (E. S. R., 37, p. 556). A brief account is given of banana diseases, falling mainly into three groups, the Philippine bacterial disease, the Pusa disease, and diseases of the Panama disease type, the symptoms of the last-named group including the cessation or decrease of growth of the heart leaf, the longitudinal splitting of the outer leaf sheaths, and the premature breaking and falling down of the leaves. The symptoms of the disease in the Dutch East Indies are outlined, as are the etiological studies and those on the development of the disease and its dissemination. The chief means of dissemination is the planting of diseased rootstocks, though other methods are indicated, such as the use of knives without adequate sterilization. All of the 14 species and 77 varieties tested appeared almost equally susceptible.

The external symptoms of the Javanese vascular disease are in the main the same as those of the Panama disease type, and especially of the Panama disease itself, which latter disease simply develops more rapidly.

Bunchy top in bananas (*Queensland Agr. Jour., 18 (1922), No. 5, pp. 368, 369*).—Banana bunchy top, a condition undetermined as to causation, is said to be increasing in New South Wales.

Cinnamon stripe canker, R. D. RANDS (*Dept. Landb., Nijv. en Handel [Dutch East Indies], Meded. Inst. Plantenziekten, No. 54 (1922), pp. 54, pls. 6*).—A descriptive account is given of a disease attacking wounded cinnamon (*Cinnamomum burmanni*) below the soil surface. This disease has for years caused important losses on the west coast of Sumatra. The causal organism is described as a new species, *Phytophthora cinnamomi.*

Phloem necrosis of Liberia coffee in Surinam, G. STAHEL (*Dept. Landb. Suriname Bul. 40 (1920), pp. 31, pls. 13*).—Pursuant to the preliminary account by himself previously noted (E. S. R., 39, p. 152) and relevant to an early discussion by Kuyper (E. S. R., 30, p. 750), the author now reports studies claimed to show that Liberia coffee sieve tube disease, or phloem necrosis, may manifest itself as an acute form of root disease, or as a chronic form causing a gradual death of the parts involved and preceded by the fall of the older leaves. Considerable similarity is noted with potato leaf roll (phloem necrosis).

Preliminary study of the coffee leaf disease due to Hemileia vastatrix, J. VIZIOLI (*Bol. Agr. [Sao Paulo], 23. ser., 1922, Nos. 3–4, pp. 87–118, pl. 1, figs. 5; 5–6, pp. 152–188, figs. 25*).—A systematic account is given of the coffee leaf disease due to *H. vastatrix* in different regions, noting more particularly the phases and conditions threatening coffee interests in central Brazil.

The leaf spot of coffee in Porto Rico, T. B. MCCLELLAND (*Porto Rico Sta. Bul. 28 (1922), Spanish ed., pp. 9, pls. 4*).—An English edition of this bulletin has been noted previously (E. S. R., 46, p. 454).

A disease of mandarin, G. CAMPANILE (*Staz. Sper. Agr. Ital., 55 (1922). No. 1–3, pp. 5–12, figs. 4*).—Mature or submature mandarin (*Citrus deliciosa*) fruits in Italy are subject to a spotting disease, said to be due to a fungus which is here described as a new species under the name *Cytosporina citriperda.*

On the control of the brown rot disease of oranges, G. SAMUEL (*Jour. Dept. Agr. So. Aust., 26 (1922), No. 4, pp. 322–324, fig. 1*).—Orange brown rot, though new to South Australia, caused considerable damage in the southern districts during the previous warm season, due to heavy rainfall. The results of these conditions as regards spore dispersal are expected to appear in a wide extension of the disease.

White pine blister rust, R. H. ALLEN (*Mass. Dept. Agr. Ann. Rpt., 1920, pp. 76–79*).—White pine blister rust control work, based on eradication of Ribes by crews representing mainly cooperative action by the Massachusetts Department of Agriculture, Division of Plant Pest Control, and the U. S. D. A. Bureau of Plant Industry, was in operation in 11 towns, costing 54 cts. per acre, of which 46 cts. was for labor, 3 cts. for supervision, and 5 cts. for transportation and other expenses. The methods employed are outlined.

Intensive examinations show that eradication work lowers infection greatly. A detailed summary in tabular form is presented of the work during the season.

Black currant rust, J. W. EASTHAM (*British Columbia Fruit-Growers' Assoc. Ann. Rpt., 32 (1921), pp. 42–44*).—It appears that the measures taken to prevent the entrance of currant rust, or white pine blister rust, into British Columbia were instituted too late. The disease is said to have been noted last fall at places on Vancouver Island and the lower mainland, and it is probable that it has been present for some time. Though present also on red currant and on ornamental white pines, the infection is confined almost entirely to cultivated black currant, and this is the main source of danger. The large

white-pine interests of this section and neighboring portions of the United States are discussed in this connection.

The cause of rustiness in rubber from Hevea brasiliensis, J. Groenewege (*Dept. Landb., Nijv. en Handel [Dutch East Indies], Meded. Alg. Proefsta. Landb., No. 11 (1921), pp. 19, pl. 1*).—Rustiness in sheet rubber is due to the presence of species of Saccharomyces and Oidium, which grow at the expense of the serum constituents of the rubber, forming a dull-appearing layer showing the consistency of butter and a tendency to scale off in stretching.

Quebrachite and proteins are the nutrients in the serum, the first named being assimilated by *Torula heveanensis*, which was isolated and is here named as the most important organism causing rustiness in rubber, the conditions favoring it as compared with other yeasts and with Oidium.

Organisms causing rustiness must be able to live in a weak acid medium and to secure their carbon and nitrogen from quebrachite and proteins, or from proteins alone. *Bacterium prodigiosum* grows well in a slightly acid medium containing quebrachite and proteins and is included among the organisms causing rustiness.

Freshly rolled and sterilized rubber becomes badly rusted in 24 hours, but if kept under water for several days it becomes immune, a rich bacterial growth developing in the water.

Dry rubber, after it is again wet and dried, is found to have become practically immune to rustiness, owing to reduction of permeability on drying. This change of permeability is irreversible. On the basis of the irreversible changes during the drying of rubber, several phenomena described in the literature are explained.

An obscure disease of yew, II, D. Spierenburg (*Verslag. en Meded. Plantenziektenkund. Dienst Wageningen, No. 24 (1922), pp. 31, pls. 4, fig. 1*).—The information previously noted (E. S. R., 46, p. 741) is followed up with an account of the disease, yew varieties affected, symptoms, supposed relations to insects, etc., also microscopic and culture studies on the disease which have not yet proved conclusive as to the identity of the causal organism.

ECONOMIC ZOOLOGY—ENTOMOLOGY.

The importance of bird life, G. I. Hartley (*New York: Century Co., 1922, pp. [9]+316, pls. 12*).—This is a popular account of the economic significance and conservation of bird life.

The purpose of bird censuses and how to take them, M. T. Cooke (*U. S. Dept. Agr., Dept. Circ. 261 (1923), pp. 4*).—This is a brief account of bird censuses, their value and manner of taking.

The numbers and local distribution in summer of Illinois land birds of the open country, S. A. Forbes and A. O. Gross (*Ill. Nat. Hist. Survey Bul., 14 (1922), Art. 6, pp. 187–218, pls. 33*).—This is a report of investigations in continuation of an earlier statistical study.[1]

Food habits of Callisaurus ventralis ventralis (Hall.), H. J. Pack (*Biol. Soc. Wash. Proc., 36 (1923), pp. 79–81*).—In examinations made of the stomach contents of 20 specimens of this lizard taken at St. George and Santa Clara, Utah, in June, 1920 and 1921, vegetable matter formed 10.4 per cent and insects 89 per cent, the remaining 0.6 per cent consisting of spiders and sand.

The food habits of Cnemidophorus tessellatus (Say), H. J. Pack (*Biol. Soc. Wash. Proc., 36 (1923), pp. 85–89*).—In examinations of the stomach contents of 63 specimens of this lizard, it was found that Lepidoptera, largely

[1] Bul. Ill. State Lab. Nat. Hist., 9 (1913), Art. 6, pp. 373–385.

caterpillars, formed 37.7 per cent of the total bulk of food, grasshoppers 14.4, miscellaneous insects 14.27, arachnids 8.2, etc.

A quantitative study of the insecticidal properties of Derris elliptica (tuba root), J. C. F. Fryer, R. Stenton, F. Tattersfield, and W. A. Roach (*Ann. Appl. Biol., 10 (1923), No. 1, pp. 18–34, figs. 3*).—In investigations here reported it was found that extracts of *D. elliptica* have a high insecticidal value, particularly for caterpillars. They are not so toxic to aphids.

"The principles of the root toxic to insects are the white crystallin derivative, usually called 'tubatoxin,' and a resin of a golden yellow color identical with the 'derride' of Sillevoldt. Both these compounds when finely dispersed in water have considerable toxic properties to insects. The dry root itself may be used in a finely powdered condition worked up with water, together with soap or other emulsifying reagents.

"As the pure poisons found in derris root are solids and only slightly soluble in water, their toxicity appears to depend upon their degree of dispersion. A biological method of determining insecticidal properties quantitatively is described. It depends on dipping insects for a constant period of time in known strengths of highly dispersed suspensoids in dilute aqueous solutions of saponin."

Experiences of the entomology department in insect control, R. A. Cooley (*Montana Sta. Rpt. 1921, pp. 49–55, figs. 2*).—A discussion is first given of the occurrence and work with the pale western cutworm (pp. 49–51), accounts of which by Parker et al. have been noted (E. S. R., 46, p. 352), and of other cutworms. This is followed by a discussion of the fruit-tree leaf-roller, investigations of which in the Bitter Root Valley during the season demonstrated that many of the commercial brands of miscible oils used against it are unsatisfactory, Dormoil having been the only brand that gave dependable results. This oil is used at the rate of 1 gal. to 11.5 gal. of water, and is best applied with a spray gun giving a fine mist under a pressure of 275 to 300 lbs. It was demonstrated that a thorough application of arsenate of lead at the rate of 3 lbs. of powder to 100 gal. of water, applied while the caterpillars are still small, will greatly aid in reducing the infestation, but should not be relied upon solely in severe cases.

In a discussion of the occurrence of grasshoppers and work therewith it is reported that poisoned bran mash applied between 7 and 11 a. m. gives the most satisfactory results.

[Insect control in New York State] (*N. Y. State Hort. Soc. Proc., 67 (1922), pp. 35–78, 118–124*).—The papers presented at the annual meeting of the New York State Horticultural Society held at Rochester, N. Y., in January, 1922, include the following: Control of Sucking Insects by Dusting, by P. J. Parrott (pp. 35–49); Pear Psylla Problems, by F. Z. Hartzell (pp. 50–55); Cooperative Experiments with Lime Nicotin Dust Against Hard Shell Nymphs and Adults (pp. 55–65) and Control of Codling Moth in Western New York: The Value of Midsummer Applications (pp. 65–73), both by L. F. Strickland; Side Lights on Insect Control in Orchards, by E. P. Felt (pp. 73–78); and Paradichlorobenzene for the Control of the Peach Tree Borer, by A. L. Quaintance (pp. 118–124).

Insect enemies of chrysanthemums, C. A. Weigel (*U. S. Dept. Agr., Farmers' Bul. 1306 (1923), pp. 36, figs. 33*).—This is a summary of information on the more important insect enemies of chrysanthemums and means for their control.

[Insect enemies of the rubber tree], T. Petch (In *The Diseases and Pests of the Rubber Tree. London: Macmillan & Co., Ltd., 1921, pp. 224–260, pl. 1, figs. 3*).—This is a summarized account of the important insect enemies of the rubber tree and means for their control.

The storage of grains, C. SMEE (*Nyasaland Dept. Agr. [Bul.] 1 (1922), pp. 5*).—This is a popular summary of information, with directions for the use of heat and of carbon disulphid against stored grain pests.

The greenhouse thrips out of doors in northeastern Georgia (*Fla. Ent., 6 (1922), No. 2, p. 23*).—The author records the collection of *Heliothrips haemorrhoidalis* from a wild shrub near Clayton, Ga. This species had never before been taken outside of greenhouses except in the southern end of Florida.

Injuries, life history, and control of the apple sucker (Psylla mali Sch.), W. H. BRITTAIN (*Sci. Agr., 3 (1923), No. 5, pp. 176–188*).—This is a summary of the present status of the knowledge of *P. mali*, consisting largely of a review of the literature, of which a list of 60 titles arranged in chronological order is included. Experiments by the author, carried on in continuation of those previously noted (E. S. R., 47, p. 656), will be reported in another article.

The rhododendron bug (Stephanitis (Leptobyrsa) rhododendri Horv.), and a report upon experiments with various insecticides, A. H. HOARE (*Jour. Roy. Hort. Soc., 48 (1923), No. 1, pp. 16–21*).—A brief account of this insect, which causes serious damage to rhododendrons in English nurseries and gardens, is followed by a more extended account of remedial measures. Experiments with insecticides indicate that it may be successfully controlled by spraying with a soft-soap wash, soap and nicotin, paraffin emulsion, or whale-oil soap, two sprayings being necessary to effect a complete clearance, especially if the bushes are badly infested.

Biological studies of Aphis rumicis L.: The penetration of plant tissues and the source of the food supply of aphids, J. DAVIDSON (*Ann. Appl. Biol., 10 (1923), No. 1, pp. 35–54, pls. 2, figs. 4*).—The author here considers the technique and methods employed, the mouth parts and their relation to the phenomenon of suction, the penetration of the plant tissues by the stylets, the stylet sheath, the effects of the stylets and salivary secretion, the sources of the food supply, and the excretion of honey dew.

The San José scale, J. J. DAVIS (*Purdue Agr. Ext. Bul. 114 (1923), pp. 12, figs. 5*).—A summary of information on the most serious orchard insect pest occurring in Indiana. It is said to have been increasing in destructiveness in the State and more particularly in the southern half.

The control of red scale in pear orchards, F. W. PETTEY (*Union So. Africa Dept. Agr. Jour., 5 (1922), No. 4, pp. 337–342*).—This is a report of spray experiments at Elsenburg during the fruit seasons 1920–21 and 1921–22. It was found that a dormant spray of concentrated lime sulphur, concentrated to 4, 5, or 6° B., will not satisfactorily control red scale on pear trees when infestation is considerable.

"One-half pound of calcium caseinate in 40 gal. of concentrated lime sulphur diluted to 5° (1–8) will control red scale considerably more effectively than the same mixture with calcium caseinate omitted. A dormant spray of concentrated lime sulphur of 4°, followed by two foliage sprays of 1° or slightly less (diluted 1–50), will effectively control red scale. Concentrated lime sulphur diluted to 1° or slightly less causes some burning of foliage, even in coastal regions, but evidently not sufficient to affect the crop. It can not be recommended in inland districts and should be applied with caution in coastal regions. South African manufactured miscible oil diluted 1–18 controlled red scale during 1921–22 fruit season as effectively as one dormant spray of concentrated lime sulphur of 4° (1–10), followed by two foliage sprays of concentrated lime sulphur of approximately 1°, applied at the time of the first two codling sprays. Miscible oil is, however, considerably more expensive, and especially when a fungicide must be used as a foliage spray."

The biology of the Chrysopidae, R. C. SMITH (*New York Cornell Sta. Mem. 58 (1922), pp. 1291–1372, pls. 4, figs. 83*).—The work here presented, based upon a study of some 15 species of Chrysopidae, extending over a period of more than four years, largely at Ithaca, deals with the history of the family, method of study, life history, economic importance, and descriptions of the life stages of 11 species. A bibliography of 5 pages is included.

The fumigation of cotton seed with chloropicrin, P. VAYSSIÈRE (*Agron. Colon., 7 (1922), No. 56, pp. 249–253; abs. in Internatl. Inst. Agr. [Rome], Internatl. Rev. Sci. and Pract. Agr., 13 (1922), No. 12, p. 1624*).—In three experiments here reported, made in 1921 and 1922 with cotton badly infested with the pink bollworm and with perfectly sound seed, it was found that chloropicrin at the rate of 30 cc. per cubic meter with an exposure of 24 hours gives complete disinfection to seeds without affecting their germination.

Report on the diseases of silkworms in India, A. P. JAMESON (*Calcutta: Govt., 1922, pp. [V]+165, pls. 8, figs. 8*).—Following a historical sketch of diseases of silkworms in India, the author deals, respectively, with pebrine; muscardine; the fly pest, *Ostraea bengalensis* (*Tricolyga bomycis*), and other tachinid parasites; and wilt diseases, including flacherie, gattine or lucettes, jaundice or grasserie, and court. Then follows a chapter on diseases of the muga silkworm (*Antheraea assamensis*), a note on diseases of the eri worm (*Attacus ricini*), and a note on diseases of the tasar silkworm (*Antheraea mylitta*). Additional data are given in five appendixes, and a bibliography of 30 titles is included.

The Achemon sphinx moth in California (Pholus achemon Dru.), A. J. FLEBUT (*Calif. Dept. Agr. Mo. Bul., 12 (1923), No. 1–2, pp. 12–33, figs. 13*).—This is an account of the life history and habits and means of control for *P. achemon*, an account of which pest by Nougaret has been previously noted (E. S. R., 43, p. 453). Its control is said to be simple, consisting of a spray composed of 5 lbs. dry lead arsenate (10 lbs. paste) with 1.5 to 2 lbs. of casein spreader to 200 gal. of water.

A corn-feeding geometrid, Pleuroprucha insulsaria Guen., G. G. AINSLIE (*Ohio Jour. Sci., 23 (1923), No. 2, pp. 89–101, fig. 1*).—This is a report of observations of a small geometrid, the larva of which has occurred for several years on corn silks in varying abundance. The species has never received the attention of economic entomologists, since the injury it causes is trifling.

Summary of codling moth investigations, with spraying schedules, A. B. FITE (*New Mexico Sta. Bul. 135 (1923), pp. 24, figs. 7*).—This is a brief practical summary of the results obtained in investigations of the life history and bionomics of the codling moth and in banding records, previously noted (E. S. R., 47, p. 457). Demonstration work in spraying by the department of horticulture, in which different schedules ranging from three to nine applications were tested, led to the conclusion that the six-spray schedule tabulated for winter apples and the three-spray schedule tabulated for Bartlett pears will prove best for most varieties in the lower and warmer valleys. Since only 6 per cent of the season's eggs belong to the first brood, while 79 per cent of all eggs for the season were deposited during July and August and the fruit crop is occasionally lost by late spring frosts after the calyx spray has been given, some growers are led to question the advisability of making the calyx spray. After studying all available data, however, it was decided to retain the calyx spray in the schedules recommended.

A brief summary of the budworm investigations in Canada, F. C. CRAIGHEAD (*Jour. Forestry, 21 (1923), No. 2, pp. 134–138*).—This is a brief statement of work with the spruce budworm in Canada.

The European corn borer in Ontario, G. J. SPENCER and H. G. CRAWFORD (*Ontario Dept. Agr. Bul. 295 (1923), pp. 11, figs. 10*).—This summary report upon control work conducted in Ontario has led the authors to advocate the increased use of the silo, the destruction by burning of all refuse corn stalks and cobs, the complete plowing under of all refuse on the cornfield, and the planting of the new crop as late as possible with a small trap crop as early as possible.

A fatal disease of the caterpillars of Galleria mellonella, KITAJIMA and METALNIKOV (*Compt. Rend. Soc. Biol. [Paris], 88 (1923), No. 7, pp. 476, 477*).—This is a report of studies, in continuation of those previously noted (E. S. R., 48, p. 54), made during the course of a second epidemic among caterpillars of the bee or wax moth. The two organisms were separated and a study made of their action upon *G. mellonella*. The intoxication produced by endotoxins is the principal cause of the mortality.

A new orange pest in Arizona, D. C. MOTE (*Calif. Dept. Agr. Mo. Bul., 11 (1922), No. 8–9, pp. 628–631*).—The author reports upon the infestation of the Washington and Australian varieties of oranges in the groves of the Salt River Valley of Arizona by a small, pinkish larva that feeds in the center of the bast fiber of the orange.

This insect, which was described from Mexico by Dyar in 1915 as *Myelois venipars* n. sp. (E. S. R., 34, p. 855), is found feeding either in or near the bast fiber, or core, of the orange with a mass of frass near by. When nearly mature the larva eats its way to the rind of the orange, either at the navel end or a little to one side of it, and then eats a circular hole almost through the rind. A cocoon joined to the edges of this circular hole is woven by the larva, within which it changes to the pupal stage. In the majority of instances the worm was found only in the oranges lying on the ground. Notes on its life history, made by F. H. Gates from July to December, 1921, are included. Since the larva is found within the fallen orange for a period of from 30 to 60 days, the gathering and destroying of all fallen oranges is suggested as a method for combating the pest. A paper on the history of *M. venipars* in Arizona, by the same author, follows (pp. 632, 633). Whether the pest precedes the black rot of the orange due to *Alternaria citri*, or whether the rot precedes the insect, remains to be determined.

Report of campaign against Spodoptera mauritia Boisd. (Noctuidae) in Malabar, E. BALLARD (*Agr. Research Inst., Pusa, Bul. 132 (1922), pp. 60–68, pls. 5*).—The account here presented, which includes a discussion of the life history and habits of this important rice pest, has been previously noted from another source (E. S. R., 47, p. 357).

Forecasting outbreaks of the pale western cutworm in Alberta, H. L. SEAMANS (*Canad. Ent., 55 (1923), No. 3, pp. 51–53*).—The author reports that under the weather conditions that have existed in southern Alberta for the last five years the main parasites of *Porosagrotis orthogonia* Morr. have been two species of tachinids and an occasional braconid. The rearing records for 1922 are said to show that, in addition to these parasites, there also occurred a bombyliid, a chalcid, two ichneumonids, and a third tachinid, all being species which are commonly associated with surface-feeding noctuids.

"There has apparently been no increase or decrease in the numbers of parasites from year to year, but the increase in parasitized *P. orthogonia* larvae can be distinctly correlated with the number of days in May and June when cutworms are forced to the surface because of moisture. It should be possible to determine to some extent the presence or absence of cutworms for any year by the number of wet days during the preceding May and June combined."

A study of the malarial mosquitoes of southern Illinois.—II, Operations of 1920, S. C. CHANDLER (*Ill. Nat. Hist. Survey Bul., 14 (1921), Art. 3, pp. 23–32, figs. 5*).—This is a report of mosquito survey work carried on during the season of 1920, in continuation of previous operations (E. S. R., 43, p. 558).

A note on transmission of surra by Tabanus nemocallosus, H. E. CROSS and P. G. PATEL (*Punjab Dept. Agr., Vet. Bul. 7 (1921), pp. 7, pls. 4*).—In work here reported 31 experiments were conducted, 9 consisting of interrupted feeds and 22 of noninterrupted feeds.

On microscopical examination of this species of Tabanus no live trypanosomes were found four hours after they had fed on a surra-infected animal, while in *T. albimedius* they have been found alive after eight hours. Though a positive result was obtained with two flies with an interval of 10 minutes between the feeds, it appears that the transmission of surra depends upon (1) the number of flies, (2) the interval of time between the interrupted surra-infected feed and the feed on the healthy animal, and (3) the number of trypanosomes in the peripheral circulation of the surra-infected animal when the feed takes place.

Investigations of the fecundity and longevity of the house fly, E. ROUBAUD (*Ann. Inst. Pasteur, 36 (1922), No. 11, pp. 765–783, fig. 1*).—The author presents the details of his investigations of the biology of *Musca domestica.*

The sheep blowfly in South Africa, H. K. MUNRO (*Union So. Africa Dept. Agr. Jour., 5 (1922), No. 5, pp. 449–456, figs. 6*).—Investigations of the prevalence and distribution of blowflies in South Africa have shown that at least three species are concerned in blowing sheep's wool, namely, *Pycnosoma chloropyga* Wied., *P. albiceps* Wied., and *Lucilia sericata* Meig.

The cherry fruit-fly, A. L. LOVETT (*Oregon Sta. Circ. 35 (1923), pp. 4, figs. 3*).—A brief popular summary of information on the cherry fruit-fly.

Pegomyia hyoscyami Panz. and its control, R. KLEINE (*Bl. Zuckerrübenbau, 30 (1923), No. 1, pp. 1–23, figs. 12*).—This consists of a discussion of the occurrence and distribution of the pest in Pomerania, its economic importance, biology, and means of control. Studies by Cameron (E. S. R., 32, p. 351) and by Cory (E. S. R., 36, p. 57) have been noted.

Dispersion of the boll weevil in 1922, F. F. BONDY, R. C. GAINES, W. B. WILLIAMS, and M. T. YOUNG (*U. S. Dept. Agr., Dept. Circ. 266 (1923), pp. 6, fig. 1*).—This is a detailed discussion of the migration of the boll weevil in 1922, accompanied by a map showing its dispersion from 1892 to 1922.

The Philippine cotton boll weevil, H. E. WOODWORTH (*Philippine Agr., 11 (1922), No. 3, pp. 75–81, pl. 1; abs. in Rev. Appl. Ent., 11 (1923), Ser. A, No. 2, p. 94*).—The cotton boll weevil *Amorphoidea lata* Motsch. is said to be widely distributed in the Philippines, where it is the most important insect enemy of cotton. The bolls attacked by the larvae fall to the ground without producing mature seeds or fiber.

The effect of sodium hypochlorite upon the spores of American foulbrood (Bacillus larvae), H. F. WILSON and W. A. HADFIELD (*Science, 57 (1923), No. 1472, p. 334*).—The authors' experiments, conducted with various preparations of sodium hypochlorite, have shown that this chemical has a solvent action on dead bees, pollen, cocoons, and other débris in the combs. It does not injure the wax, and while certain concentrated solutions will dissolve a dead bee in a short time, diluted they are not at all harmful to the bees when added to their food. A special solution was found to be 100 per cent efficient in disinfecting hive bodies and equipment. The particular value of a special hypochlorite finally decided upon is that it destroys the spores wherever it comes in contact with them, but is not poisonous and may be fed in sirup or honey to the bees without apparent injury.

Description of a new serphoid parasite (Hymen.), R. Fouts (*Ent. Soc. Wash. Proc., 25 (1923), No. 3, pp. 64, 65, fig. 1*).—Under the name *Inostemma leguminicolae*, the author describes a new parasite on the clover seed midge, *Dasyneura leguminicola* Lint.

The ticks of Panama, their hosts, and the diseases they transmit, L. H. Dunn (*Amer. Jour. Trop. Med., 3 (1923), No. 2, pp. 91–104*).—This is a summary of information on the biology of the ixodids occurring in Panama and the knowledge of their hosts in their relation to disease transmission.

A note on Argasidae found in the Punjab, H. E. Cross and P. G. Patel (*Punjab Dept. Agr., Vet. Bul. 9 (1922), pp. 13, pls. 5*).—This is an account of the argasid ticks occurring in the Punjab, which include *Argas persicus*, *A. vespertilionis*, *Ornithodoros savignyi*, *O. lahorensis*, and *O. crossii* n. sp.

Otiobiosis, the ear tick disease, W. L. and M. E. Curtis (*Jour. Amer. Med. Assoc., 80 (1923), No. 15, pp. 1053–1055, figs. 2*).—The authors present a summary of the life history of (*Ornithodoros*) *Otiobius megnini*, together with a technical description and an account of the symptoms it produces in man. This is followed by a brief summary of 10 cases previously reported and an account of a case observed by the authors. Treatment and prophylaxis are also briefly considered.

The hop red spider, A. L. Lovett (*Oregon Sta. Circ. 36 (1923), pp. 4, fig. 1*).—A brief popular summary of information on the red spider-mite.

Contributions to the biology of Tyroglyphus mycophagus (Még.): The destruction of a brood of Tenebrio molitor by this mite, H. Schulze (*Arb. Biol. Reichsanst. Land u. Forstw., 11 (1922), No. 2, pp. 169–177, pl. 1; abs. in Rev. Appl. Ent., 10 (1922), Ser. A, No. 2, p. 567*).—This is a report of studies of the biology of a mite which parasitizes the larvae, pupae, and adults of *T. molitor*.

The control of Tyroglyphus mycophagus (Még.), H. Schulze (*Arb. Biol. Reichsanst. Land. u. Forstw., 11 (1922), No. 2, pp. 179–184; abs. in Rev. Appl. Ent., 10 (1922), Ser. A, No. 2, p. 567*).—The destruction of this parasite of *Tenebrio molitor* in all stages was accomplished by fumigation for three hours with Zyklon, a hydrocyanic acid derivative, at a strength of 15 cc. per cubic meter, for two hours with chloropicrin at a strength of 10 cc. per cubic meter. Both were also fatal to *T. molitor*.

Surra transmission experiments with Tabanus albimedius and ticks, H. E. Cross (*Punjab Dept. Agr., Vet. Bul. 12 (1923), pp. 11*).—The author gives a summary of the results obtained in interrupted and uninterrupted feeding experiments conducted during the season of 1922, the methods of feeding and types of cages used, etc., having been similar to those of previous experiments (E. S. R., 46, p. 881).

The experiments with *T. albimedius* led to the following conclusions: "*T. albimedius* is capable of transmitting surra from a surra infected animal to healthy animals. The method of transmission by *T. albimedius* is direct. Though *T. albimedius* may feed on a surra infected animal, they are incapable of transmitting the disease to healthy animals if the surra infected feed has taken place one to four days previously. The time when a surra infected animal is most dangerous as a reservoir is during a paroxysm (i. e., when trypanosomes are present in the peripheral circulation). As the paroxysms are more frequent in camels during the early stages of the disease, it follows that a freshly infected camel is more dangerous than a camel that has been suffering from the disease for a considerable time."

The experiments conducted with ticks, *Ornithodoros crossii* (Bru.), have shown that they are incapable of spreading the disease by direct transmission, but that they are capable of spreading the disease to a healthy ani-

mal 17 days and 1 month after feeding on an infected animal. This indicates that there is probably a cyclical development of the trypanosome within the tick.

Surra transmission experiments, H. E. Cross and P. G. Patel (*Punjab Dept. Agr., Vet. Bul. 5 (1921), pp. 19, pls. 9*).—In experiments carried out with five species of Tabanus and *Ctenocephalus felis*, two positive results obtained in interrupted feedings are reported, the details being presented in tabular form. The bionomics of the flies are discussed.

FOODS—HUMAN NUTRITION.

Good proportions in the diet, C. L. Hunt (*U. S. Dept. Agr., Farmers' Bul. 1313 (1923), pp. 2+24, figs. 5*).—This is a revision and extension of Farmers' Bulletin 1228 (E. S. R., 46, p. 666), which was prepared during the war period. In the revision the material regarding food selection and use has been presented to meet conditions which prevail in more normal times. The kinds of foods needed and, in a general way, the proportions for the "average" family are outlined. The illustrations are reproduced from the Food Selection and Meal Planning charts (E. S. R., 46, p. 498), with some revision to correspond to present conditions.

Corn and its uses as food (*U. S. Dept. Agr., Farmers' Bul. 1236 (1923), pp. 26, figs. 5*).—This replaces an earlier publication (E. S. R., 19, p. 257). Topics discussed include ways in which corn is used for human food, the food value of corn and various products made from it, using corn meal for the preparation of breads and other dishes, and the use of corn flour, hominy, breakfast foods, pop corn, and fresh, canned, and dried green corn.

The place of proteins in the diet in the light of the newer knowledge of nutrition, H. H. Mitchell (*Amer. Jour. Pub. Health, 13 (1923), No. 1, pp. 17–23*).—This is a critical discussion of recent literature on the utilization of animal and vegetable protein in nutrition, together with some experimental data from the author's laboratory.

In nitrogen balance studies on rats for the purpose of calculating the biological values of different proteins according to Thomas, it was found that at a low level, 5 per cent or less of the ration, the utilization of the absorbed nitrogen was in general good regardless of the nature of the protein. The biological values of the different proteins fed at a 5 per cent level are given as follows: Veal 97, milk 94, beef 92, rice 88, oat 82, yeast 77, coconut 77, corn 73, soy bean 73, casein 71, potato 69, and navy bean 29. When fed at a level of from 8 to 10 per cent the values were veal 84, milk 83, beef (8 per cent) 81, beef (10 per cent) 68, rice bran 68, yeast 67, cottonseed 66, oat 65, soy bean 64, potato 63, alfalfa 62, corn 58, coconut 58, navy bean 38, and tankage 33.

In discussing these results, together with data reported from other laboratories, the author concludes that the tendency is "to minimize the differences existing among the protein values of the staple foods of the American diet," but that in the balancing of dietaries not only the biological values of the separate proteins but their supplementary values must be taken into consideration, and that this value does not represent the mean value of the proteins themselves. Regarded from this standpoint the animal proteins, meat, milk, and eggs, are considered important, particularly for children and convalescents, in supplementing the cereal proteins which make up some 43 per cent and the legume proteins some 9 per cent of the American diet.

Colorimetric studies on tryptophan.—VII, The tryptophan requirement of growing rats, O. Fürth and F. Lieben (*Biochem. Ztschr., 132 (1922), No. 4–6, pp. 325–342, figs. 2*).—In this continuation of the studies on tryptophan

(E. S. R., 46, p. 758) the authors have attempted to control the tryptophan consumption of rats during a long experimental period (22 to 25 weeks) by the use of foods of known tryptophan content, and to calculate by tryptophan determinations in growing animals how great a proportion of the food tryptophan is to be found in the body substances of growing animals and how great a proportion is broken down or eliminated.

Two series of 4 young rats from the same litter were used in the experimental work. In each group 2 animals received a tryptophan-poor and 2 a tryptophan-rich diet, the protein content of which was kept the same. At the end of the experimental period the animals were killed and analyzed for tryptophan. The foundation tryptophan-rich protein of the diet was yeast (with meat and dried milk in a few cases). For the tryptophan-deficient protein, part of the yeast was substituted by gelatin, with suitable additions of tyrosin and cystin to make up for the deficiencies of gelatin in these acids.

The growth of the animals on the tryptophan-rich diet was somewhat more rapid than that of those on the tryptophan-poor diet. The tryptophan content of the animals at the end of the experiment was, however, practically the same, averaging 0.23 per cent of the body weight, a figure closely corresponding to the average content of tryptophan in the human body. The calculation of the tryptophan balance showed that of the food tryptophan only a small percentage, from 3 to 8, was utilized in the building of body protein, the rest being decomposed or eliminated.

The calculated tryptophan requirement for a growing rat is given as 0.07 to 0.13 gm. per day per kilogram of weight. Compared with previous estimations of the tryptophan requirement of human beings this requirement is double that of an infant and from 3 to 6 times that of a growing child. This difference is attributed to the greater intensity of metabolism of rats than human beings and also to their greater surface area.

The ammonia excretion in hunger osteopathy and in chronic undernutrition, D. Adlersberg (*Biochem. Ztschr., 132 (1922), No. 1–3, pp. 2–17*).—Data are reported on the total and ammonia nitrogen content of the urine of 7 patients suffering from hunger osteopathy, of 2 normal controls, and of 2 of the patients 15 months later after they had been discharged from the clinic cured.

The cases of chronic undernutrition, with or without pathological bone conditions, showed a significant increase in the ammonia content of the urine which would be sufficient to serve as a differential diagnosis for this condition. A lowering of the alkaline reserve of the blood by pathological products could not be detected.

The vitamins and their relationship to health and disease, A. D. Emmett (*Ther. Gaz., 45 (1921), Nos. 11, pp. 768–772, fig. 1; 12, pp. 847–853; 46 (1922), No. 1, pp. 17–24*).—This is a general discussion of vitamins, including a brief historical introduction, classification and properties, tests for occurrence, and practical applications with respect to clinical medicine. The last named section, to which particular emphasis is given, contains an interesting table compiled from various sources of the comparative effect of the deficiency of vitamins A, B, and C on appetite, growth, weight, digestive organs, heart, blood, endocrine glands, testes, ovaries, liver, spleen, eyes, leg and rib bones, teeth, and nerve centers.

Can the disturbances in growth from lack of vitamins be influenced by chemically defined substances? D. Ogata (*Biochem. Ztschr., 132 (1922), No. 1–3, pp. 89–94, figs. 6*).—To test the theory advanced by Bickel that the essential function of vitamins is to accelerate the assimilation of digested food materials by the body cells (E. S. R., 47, p. 265), an investigation was undertaken

to determine whether animals on a vitamin-free diet would respond more quickly than those on a normal diet to the action of substances known to hasten the breaking down of body cells. Two groups of 9 rats received, respectively, a normal ration supplemented with butter and a diet of polished rice with a salt mixture of common salt, calcium lactate, magnesium citrate, and ferric citrate. Each group was further subdivided into three groups, one of which received no addition to the basal diet, one 0.025 gm. of sodium iodid per 100 gm. weight, and one 0.01 gm. of a thyroid extract per 100 gm. weight. The animals were weighed weekly and the gain or loss in weight tabulated as percentage of the weight at the beginning of the experimental period.

A comparison of the results obtained in the two groups showed a large percentage gain in the group receiving the normal diet with no addition, and smaller gains for the other two subgroups receiving, respectively, sodium iodid and thyroid extract. On the vitamin-free diet, however, there was a loss in weight in the group receiving no addition and still greater losses in the other two subgroups.

These results are thought to give further proof that the presence of vitamins assists in the assimilatory processes of the body cells.

The rôle of vitamins in tropical diseases, J. A. SHORTEN (*Indian Med. Gaz., 57 (1922), No. 5, pp. 164–169*).—The subject is discussed under two main heads, (1) the effect of general vitaminic deficiency in interfering with digestion, absorption, and utilization of foodstuffs, thereby producing a state of malnutrition and lowered resistance to infection and (2) the specific effect of absence of certain classes of vitamins, causing the so-called deficiency diseases. Under the first head the author reviews the work of McCarrison on deficiency disease (E. S. R., 47, p. 369), and under the second head discusses the sources, properties, and effects of the deficiency of each of the three vitamins and the diseases with which each is associated.

A study of the adequacy of certain synthetic diets for the nutrition of pigeons, K. SUGIURA and S. R. BENEDICT (*Jour. Biol. Chem., 55 (1923), No. 1, pp. 33–44, pl. 1, figs. 3*).—In this study of the nutritive requirements of pigeons it is reported that a diet of casein 22, cane sugar 10, starch 27, agar 2, salt mixture 3, butter fat 30, and yeast 6 per cent is adequate for fertile egg production, growth, and maintenance of common pigeons provided at least 15 gm. of the food is consumed daily. The same diet, altered to the extent of increasing the starch from 27 to 37 per cent and substituting 20 gm. of lard for 30 of butter, is said to have given satisfactory growth and egg production, although it is noted in the protocols for one of the experiments that, while the squabs showed no marked abnormalities, "their body growth was somewhat slow and the growth of the feathers was somewhat delayed." On omitting the fat entirely from the original diet and adding cane sugar solution in varying amounts, it was found that with a daily ration of 12 gm. of the fat-free diet, together with 4 cc. of the sugar solution furnishing 2.74 gm. of sugar, the growth of the pigeons was below normal and the females failed to lay eggs. By feeding artificially a larger amount of this ration, eggs were laid and hatched successfully. The authors conclude that the pigeon requires neither vitamin A nor vitamin C.

Vitamin studies, L. MARCHLEWSKI and Z. WIERZCHOWSKI (*Pam. Państ. Inst. Nauk. Gosp. Wiejsk. Pulawach (Mém. Inst. Natl. Polonais Écon. Rurale Pulawy), 2 (1922), A, Nos. 1, p. 160; 2, pp. 161–187*).—A method of concentrating vitamin B from wheat bran is described, in which 1 kg. of bran was extracted with 6 liters of 0.1 per cent HCl for 6 hours at a temperature not exceeding 50° C., the liquid was filtered, the residue subjected to pressure, and the filtrate and

press juice combined and neutralized with ammonia. The precipitate which formed proved to be inactive in curative tests with pigeons.

A portion of the filtrate was treated with an acid solution of mercuric nitrate, the precipitate obtained digested with hydrogen sulphid, the filtrate evaporated to dryness, and the residue dissolved in water. This extract proved inactive.

Another portion of the original filtrate from the ammonia precipitate was treated with an ammoniacal solution of silver nitrate. The brownish-green precipitate thus formed was dissolved in hydrochloric acid, the solution evaporated to dryness, and the residue dissolved in a small amount of water. The solution proved very active, while the original filtrate from the silver precipitate was inactive.

The active solution, on neutralization with sodium hydroxid, gave an inactive precipitate and an active filtrate. On the addition of pulverized picric acid to this filtrate small prismatic crystals separated which, after removal of excess picric acid, had pronounced curative properties. The crystals had no definite melting point, melting gradually at from 180 to 200°.

A contribution to the knowledge of supplementary foodstuffs.—(The influence of fat- and cholesterol-deficient food on the growing organism), P. Niemes and L. Wacker (*Arch. Expt. Path. u. Pharmakol., 93 (1922), No. 4–6, pp. 241–268*).—The investigation reported in this paper was undertaken to determine whether cholesterol is an essential food constituent. Young rats were fed a bread made from skim milk, starch, and sugar, while controls from the same litter received a similar bread made from whole milk, starch, and sugar.

It was found that while grown rats could be maintained for as much as 4 months on the skim milk diet without harmful results, young rats, after a brief period of continued growth, showed increased susceptibility to infection and died after 2 or 3 months. On adding cholesterol, either in the free form or as esters, to the skim milk diet, the animals died even sooner than on the skim milk diet without cholesterol. The addition of cholesterol to the whole milk diet did not improve the growth of the young control animals. It is concluded that if cholesterol is essential to the organism it can act only in the presence of an unidentified substance [vitamin A].

Eggs as a source of vitamin B, T. B. Osborne and L. B. Mendel (*Jour. Amer. Med. Assoc., 80 (1923), No. 5, pp. 302, 303*).—The authors, with the cooperation of H. C. Cannon, have determined the amount of dried egg yolk and a water extract of egg yolk required as the sole source of vitamin B for rats.

For a 100-gm. rat at least 0.8 gm. of dried egg yolk per day (equivalent to 10 per cent of the food mixture) was necessary even to approximate normal growth. The dried residue of the water extract of egg yolk required a daily intake of 0.033 gm., equivalent to 2.25 gm. of moist or 1.12 gm. of dried egg yolk, to permit growth at less than normal rate. On increasing the dose to 0.066 gm. daily satisfactory growth was secured. This dried product is, therefore, comparatively rich in vitamin B, but considered in terms of the whole egg or even of the yolk the content of vitamin B is not large. "Judged by the comparative trials on rats, the average sized hen's egg is equivalent in vitamin B potency to about 150 cc. of cow's milk, or a quart of milk and six or seven whole eggs of the average sort have an approximately equivalent vitamin B value."

The enzymic activity of the digestive apparatus in avitaminosis, C. Artom (*Arch. Farmacol. Sper. Sci. Aff., 33 (1922), Nos. 8, pp. 127, 128; 9, pp. 129–132; 10, pp. 145–160; 11, pp. 161–164*).—To determine the possible effect of vitamin deficiency on the digestive enzyms, three groups of 4 pigeons each were

subjected to (1) a diet of polished rice with forced feeding after refusal to eat, (2) a diet of rice and mixed grains, and (3) starvation. When the pigeons of the first group were moribund all were killed and extracts in physiological salt solution made of the pancreas and of a portion of the mucous membrane of the small intestine, the first being tested for the enzyms lipase, amylase, and protease, and the second for invertase and ereptase.

The average values obtained were higher in every case for the pigeons on the deficient diet than on either the mixed diet or no food. For pancreatic amylase and lipase the next highest figures were those of the starvation pigeons, while for the other enzyms the second place was taken by the pigeons on the mixed diet. In discussing these results, attention is called to the possibility that this apparently greater activity of the enzyms in avitaminosis is the result of the atrophy of the organs involved, but the results are thought to preclude the possibility of a lowering of enzym activity in avitaminosis.

Changes in organ weights of the guinea pig during experimental scurvy. D. H. Bessesen (*Amer. Jour. Physiol., 65 (1923), No. 2, pp. 245–254*).—The changes in weight of various organs of the guinea pig during experimental scurvy were determined by comparing with normal values established by Bessesen and Carlson in unpublished work the weights of the same organs in groups of guinea pigs fed a scorbutic diet for 5, 10, 15, and 19 days, respectively, another group fed a scorbutic diet until death from scurvy occurred at from 21 to 54 days, and a final group fed a scorbutic diet from 19 to 22 days and then cured by administration of orange or rhubarb juice, with green feed. The animals which did not die of scurvy were killed with chloroform, and in all cases the various organs were immediately separated out and kept on moist filter paper in closed jars until the weighings could be made.

During the first 15 days or until symptoms of scurvy appeared, the changes in weight were comparatively slight and probably of no significance, although there was some evidence that the spinal cord, testes, epididymides, and bladder were above normal, and the liver, spleen, intestinal tract, and skin below normal. After the symptoms of scurvy appeared the ovaries appeared to be subnormal in comparison with the normal for corresponding body weight; the pancreas, heart, liver, testes, and skin nearly normal; the brain, eyeballs, thyroid glands, spleen, and intestines above normal; the spinal cord, lungs, kidneys, epididymides, hypophysis, and bladder markedly above normal; and the suprarenal glands very much above normal. The latter averaged 78.8 per cent above the normal for the corresponding body weight in those with early scurvy and 270.1 per cent above normal in those dead from scurvy.

These results are considered to show a general agreement with those produced by starvation, but it is considered that the results in the two cases are by no means identical and that the scorbutic condition involves factors other than those present in ordinary inanition in regard to changes in weight.

The heat resistance of Bacillus botulinus spores. J. R. Esty (*Amer. Jour. Pub. Health, 13 (1923), No. 2, pp. 105–113*).—To avoid variations in results due to unlike H-ion concentration or chemical composition of the medium, the heat resistance of spore-bearing cultures of *B. botulinus* was tested by resuspending the spore sediment in a standard well-buffered solution capable of remaining unaltered during heating at high temperatures. The material tested included 112 strains of which 37 had been responsible for outbreaks of human botulism, 13 responsible for outbreaks of animal botulism, 14 from containers suspected to contain toxic material, 13 from raw plant products, 14 from soil and grass, 13 from fatal cases of pasture disease and forage poisoning, and 8 from miscellaneous sources. Grouped according to their toxicological and serological characteristics 81 belonged to type A, 26 to type B, and 1 to a

nontoxic type. Most of the strains isolated from botulism cases and from canned food belonged to type A, while the strains isolated from raw unheated plant products, soils, and soil products were about equally divided between the two groups.

The technique employed was similar to that of Bigelow and Esty in their work on heat resistance of thermophilic bacteria (E. S. R., 45, p. 10). In the preliminary comparative study the spores were produced in canned pea infusion-peptic digest broth at pH 8, stratified with vaseline in 100 cc. pyrex tubes. In the final study of the heat resistance veal-peptic gelatin at pH 7.4 was used for the growth of the spores, after which the spore material was concentrated by centrifugalization and suspended in 50 cc. of M/15 phosphate solution of pH 7.

The extreme variations in heat resistance of the type A strains were 3 and 75 minutes when heated in the phosphate solution at 105° C., and of type B strains 3 and 60 minutes. The average heat resistance for the two strains at this temperature was 41.1 minutes for type A and 23.8 for type B. The resistance for the one nontoxic strain was 30 minutes.

The maximum heat resistance at other temperatures, as represented by the time in minutes at which no spores have survived, is 330 minutes at 100°, 110 at 105, 33 at 110, 11 at 115, and 4 at 120°. The longest survival times under the same conditions were 320, 100, 30, 10, and 4 minutes, respectively. Compared with other anaerobes *B. botulinus* is much more resistant to heat. Of the other anaerobes tested, the maximum resistance was 145 minutes at 105° for *B. sporogenes* and 24 minutes at the same temperature for *B. tetani.*

The data obtained also showed that the heat resistance of the same strain of *B. botulinus* is markedly influenced by the number of spores heated, the larger the number the greater being the resistance. The comparative heat resistance of different strains does not, however, depend upon the number of spores produced in the same medium, as a few spores of one strain may be much more heat resistant than larger numbers of other strains. Moreover, the same strain under different conditions of growth may show a marked variability in the resistance of its spores. It is considered probable that most of the spores are not specially resistant as they occur in nature, but acquire a greater resistance by selection.

Canned spinach as a source of botulism, R. B. Edmondson, C. Thom, and L. T. Giltner (*Amer. Food Jour., 18 (1923), No. 1, pp. 33–36*).—This is a report of an extensive study at the microbiological laboratory of the Bureau of Chemistry, U. S. D. A., of 653 cans of spinach from the pack responsible for the outbreak of botulism reported by Beall (E. S. R., 47, p. 771).

The examination included the appearance of the unopened can, the amount of vacuum present, the odor and appearance of the spinach, and a bacteriological study of it. In this study, of 401 of the 653 cans sent in, the results obtained agreed with those of a similar investigation in 1921 (E. S. R., 46, p. 361). Cans found free of spoilage, as determined by inspection, showed no signs of bacterial activity, while cans showing swell, of which there were 49, showed bacterial activity in 30 cases and chemical corrosion in the remaining. In only one culture was *Bacillus botulinus* found, and the spinach from this can gave negative results for toxin with guinea pigs on feeding and injection.

Since the sample responsible for the original outbreak came from a can not recognized as a swell and not showing obvious signs of spoilage, a series of 69 normal cans of the brand involved was inoculated with detoxicated *B. botulinus* spores. The cans were resealed, incubated at different temperatures, and observations made from day to day of single cans, following the same procedure as with the cans previously examined. Two strains of *B. botulinus* were used,

one the Boise strain originally isolated from canned asparagus, and the other the strain isolated from spinach in the present outbreak.

Out of 64 cans thus inoculated 3 were found to have reached a stage of toxic formation sufficient to kill guinea pigs before gas or odor had developed sufficiently to be detected on close inspection. This shows that with spinach at least it is not always possible to detect contaminaion, and that careful inspection before opening should always be followed by actual recooking of the product as it comes from the can.

ANIMAL PRODUCTION.

Growth in animals.—A biological study, with special reference to domestic animals, R. GÄRTNER (*Landw. Jahrb., 57 (1922), No. 5, pp. 707–763, figs. 4*).—This paper deals with the conception, limitations, and phenomena of growth. The differences between growth in plants and animals are discussed, and an analysis of the method by which animal growth occurs is made. Data on the growth in weight and of the more usual body measurements of cattle and other classes of domestic animals are given. Based on these data and curves of growth which have been constructed, formulas are calculated for estimating growth, weight, and the percentage constituents of the body at different ages.

A metabolism crate for calves and other small ruminants, A. C. MCCANDLISH and F. ELY (*Jour. Dairy Sci., 5 (1922), No. 6, pp. 565–569, figs. 2*).—This is a description of the method of construction of a metabolism crate designed for use in digestion and balance trials with calves, sheep, or goats where it is not necessary to take the gaseous metabolism into consideration.

Sterility in relation to animal breeding, W. S. ANDERSON (*Kentucky Sta. Bul. 244 (1922), pp. 203–234*).—Three papers dealing with sterility in males and females and methods of artificial insemination are reported.

I. *Sterile males* (pp. 204–221).—The semen of 11 stallions, 2 jacks, 3 bulls, and 2 boars were examined microscopically, and the conditions of each case are reported in detail. Sterility or partial sterility in males is classified as due to fibroid degeneration of the testes, repeated attacks of orchitis, and nonactive sperms or pus in the semen. To determine the fertility of a male the importance of making microscopic examinations of the semen is emphasized.

II. *Sterile females* (pp. 221–228).—The causes of barrenness in mares and jennets have been found to be largely ascribed to cystic ovaries, discharges resulting from vaginitis, cervicitis, or metritis, or secretions that destroy the sperms. Low fertility may be partially due to mating the animal during the heat period and at a time so far distant from the discharge of the egg that the sperms die, or mating after pregnancy has occurred, which may result in abortion.

III. *Artificial insemination* (pp. 228–234).—Methods of collecting the semen for artificial insemination and injection into mares are described by means of capsules and syringes. The results from artificial insemination have not been as good as were hoped for, but where proper care is used no harm can come from this method and the breeder has everything to gain. The greater the amount of semen injected, the greater seems to be the chances of successful fertilization. For this reason certain breeders have collected semen and injected it into a mare immediately after being bred by the stallion.

The influence of sight on the function of the testicles and on the other sex characters, C. CENI (*Arch. Entwickl. Mech. Organ., 51 (1922), No. 3–4, pp. 504–508, figs. 2*).—An account is given from the Royal University Clinic at Cagliari of a blinded rooster which remained sexually active for the first 20

days after losing its sight. It then stopped crowing at times, followed by 10 to 12 day periods in which it crowed frequently. The sperms decreased in the semen and after about 6 months it remained for periods of 1, 2, and 3 months without crowing, the glisten decreased in its feathers, and it became more like a capon. On post-mortem examination, it was found that the seminal tubules of the testicles were atrophied and the interstitial material was much increased. The results of this observation indicate a direct action of the sense of sight on the sex sense.

The mechanism of heredity, M. A. JULL (*Sci. Agr., 3 (1923), No. 5, pp. 163–168*).—The cytological and genetic evidence is reviewed, which indicates that chromosomes are the bearers of heredity.

Sex linked inheritance, H. BROOKSBANK (*Natl. Poultry Jour., 3 (1922), No. 132, p. 380*).—On the basis of the results of Punnett (E. S. R., 45, p. 369), in which he suggests the possible application of sex linked characters for determining sex in crossbred chicks at birth, the author has crossed Light Sussex hens with Brown Leghorn cockerels and sold guaranteed day-old pullets with considerable success. Such crossbreds have proved to be hardy birds and excellent layers.

The production of dark winter color.—Arbitrary darkening of yellow hair, W. SCHULTZ (*Arch. Entwickl. Mech. Organ., 51 (1922), No. 3–4, pp. 337–382, pls. 2, figs. 9*).—Experiments with rabbits, guinea pigs, and hens are reported in which changes in the color of the hair of guinea pigs and rabbits were produced by removing the hair from a certain part and subjecting the animal to modified temperature. The cold temperature was found to darken the pigment in the new growth, whereas a warmer temperature produced a lighter color. Long yellow feathers were changed into dark short feathers in fowls by the same method.

The ability of external conditions to modify these body characters is attributed directly to the action of the oxygen in the air on the hormones which modify the genes determining the characters in question. The analogy is drawn to the modifications of the secondary sex characters which occur by castration at different ages, thus stopping the effect of the internal secretions of the testicles at that time.

The factors for growth and size were found to be similarly dependent upon environmental conditions. It is concluded that the external temperature and probably light and other external conditions may modify the internal factors for growth, the hormones, or the Mendelian genes; all of which tend to determine heredity.

Some new cases of polydactylism in horses, J. E. V. BOAS (*K. Vet. og Landbohøjsk. [Copenhagen], Aarsskr. 1922, pp. 66–84, figs. 20*).—Three cases of polydactylism in horses are described, with photographs and drawings showing the condition in the living animal and the changes in the skeleton. The article is summarized in German.

Polydactylism in the horse, E. DECHAMBRE (*Rev. Zootech. [Paris], No. 15 (1922), pp. 518–522, figs. 3*).—The author has described a number of cases of polydactylism in horses which were divided into three types, as follows: (1) One digit split in its entire length, appearing like the foot of a ruminant; (2) the existence of one or more supernumerary digits of variable number on one foot or on the four feet; and (3) a defective middle digit replaced by two supplementary digits. The first and third types are relatively rare as compared with the second type. The supplementary digits develop as outgrowths of the small metacarpal or metatarsal bones.

Reconstruction and new standards of animal breeding in Germany, G. FRÖLICH (*Jour. Landw., 70 (1922), No. 2–3, pp. 117–127*).—This consists of a

discussion of the most desirable types of horses, cattle, sheep, and swine for Germany, with special reference to the work of reestablishing the live-stock industry. Data on the rates of growth of individual cattle and sheep are also given.

Report on the pastoral and dairying industries [in State of South Australia] for the year 1921–22, W. L. JOHNSTON (*So. Aust. Statis. Dept. Bul. 9 (1922), pp. 4*).—This is a statistical review of live stock and dairying in the State of South Australia for the year ended June 30, 1922.

The significance of feed units in determining the value of feeding stuffs, J. JÄNNES (*Nord. Jordbrugsforsk., 1922, No. 7, pp. 413–428*).—Comparisons of the feeding standards and of the feeding values of hays, grains, and silages, according to Kellner, Hansson, and others, are given, based on the feed units per 100 kg. of each feed and the requirements for milk production.

Composition, nutritive value, and use of silage, N. HANSSON (*K. Landtbr. Akad. Handl. och Tidskr., 61 (1922), No. 5, pp. 413–434, fig. 1*).—The changes which occur in the composition of silage during fermentation are briefly reviewed, with special reference to silage made largely of legumes. Three experiments in feeding different amounts of silage in comparison with fodder beets to dairy cattle are reported.

The results of the experiments indicated that in well prepared silage containing from 30 to 50 per cent of legumes about 6.5 kg. of first cuttings or 7 to 7.5 kg. of second cuttings contains 1.75 to 1.8 kg. of dry matter and equals 1 fodder unit. Unfermented silage has a lower feeding value, however. It is stated that from 15 to 20 or at the highest 25 kg. of silage per day might replace other succulent feeds, some straw because of the high dry matter content, and some of the higher protein feed because of the high protein content of legumes.

Sunflower silage, E. BURKE (*Montana Sta. Rpt. 1921, pp. 44, 45*).—Sunflower silage made at the station resembled good corn silage, but that at the Huntley Substation was darker in color, had a rancid odor, and lacked the pleasant acid taste of corn silage. The ratio of nonvolatile acid to volatile acid was much greater in the poor silage. It was also found that the Huntley sunflowers contained only 2.5 per cent of sugar in the dry matter, while those grown at Bozeman contained 11 per cent.

Comparative experiments of the composition and digestibility of hydrolyzed and untreated straw, W. THOMANN (*Landw. Jahrb. Schweiz, 35 (1921), No. 6, pp. 667–723, figs. 3; abs. in Biedermann's Zentbl., 51 (1922), No. 10, pp. 263–268*).—The development of the process of hydrolyzing straw is reviewed, and the more recent progress which has been made is discussed. Determinations of the composition and feeding value of hydrolyzed barley straw were made. In treating this straw, 100 kg. were chopped and cooked with 7 kg. of NaOH and 200 liters of water for 6 hours. The resulting material was neutralized with sour whey. This material was then fed to swine and fattening cattle.

In amounts of 400 gm. or less of air-dried matter per day the treated product was found to have about the same feeding value as hay for swine. The fattening cattle ate the treated feed very well in amounts of 4 to 5 kg. per day, and 100 kg. were found to have a starch value of 50 kg. It was of less value for milk production, however.

In laboratory experiments with 3 sheep, it was found by treating 100 kg. of wheat straw with 200 liters of water and 5 kg. of NaOH and cooking for 5 hours that the nitrogen-free extract consisted of from 25 to 35 per cent of lignin, 55 to 65 per cent of pentosan, and 5 to 10 per cent of other carbohydrates. The digestibility of the crude fiber was increased from 47 per cent

in the untreated to 70 per cent in the neutralized straw and to 75 per cent in treated straw from which the alkali was washed out. The digestibility of the nitrogen-free extract was increased about 7 per cent in the neutralized straw and 14 per cent in the washed straw.

One hundred kg. of dry matter in the neutralized straw had a starch value of 42.95 kg., as compared with 49.65 for straw from which the alkali was washed out. Straw treated cold by the Beckmann process had a starch value varying from 37.39 to 39.9 kg. A considerable loss of nutrients occurred when the straw was washed. A previous study by this author of hydrolyzed straw has been noted (E. S. R., 45, p. 672), some of the results of which are here cited for comparison.

The action of sodium hydrate upon the composition and digestibility of grain hulls, J. B. Lindsey and J. G. Archibald (*Science, 57 (1923), No. 1472, p. 330*).—In continuation of the work in treating fibrous materials with sodium hydroxid previously noted (E. S. R., 47, p. 70), it was found that this method increased the digestibility of barley hulls, but that it was without effect on cottonseed hulls or flax shives.

Report of analyses of samples of feeding stuffs collected in New York State, 1921 (*N. Y. State Dept. Farms and Markets, Agr. Bul. 146 (1922), pp. 343*).—The analyses for protein, fat, and fiber of samples of feeding stuffs collected during 1921 are reported. A summary of the samples collected during 1920 appeared as New York State Station Bulletin 482 (E. S. R., 47, p. 172).

Minerals for live stock, E. B. Hart, H. Steenbock, and F. B. Morrison (*Wisconsin Sta. Bul. 350 (1923), pp. 21, figs. 16*).—This is largely a discussion of the mineral needs of the different farm animals, with special reference to the salt, iodin, lime, and phosphorus requirements and the vitamin concerned in calcium assimilation, with many illustrations of experimental animals.

Developing steers, C. W. McCampbell (*Producer, 4 (1922), No. 6, pp. 8, 9*).—At the Kansas Experiment Station in the fall of 1919, 20 steer calves were divided into two lots to demonstrate the effect of winter feeding on summer pasture gains. During the winters of 1919–20, 1920–21, and 1921–22 one lot was wintered on alfalfa hay alone and the other lot on corn silage and 1 lb. of cottonseed meal per head daily. Both lots were pastured together on Kansas bluestem grass during the three summers.

The silage fed steers gained 26.66 lbs. more during the first winter, but 14 lbs. less during the following summer, than the alfalfa fed steers. All the silage that the steers would consume was fed to the lot receiving it during the second winter, and they gained 80 lbs. more per steer, but 166.54 lbs. less during the following summer than the alfalfa fed steers. In the third winter the amount of silage was restricted, and the gains were 26.59 lbs. less per steer during the winter, but 13.33 lbs. more per steer during the following summer, than were the gains of the steers receiving alfalfa alone. The indications are that summer pasture gains depend more on the amount of fat the steer carries when put on pasture than they do on the kind of feed which has been fed during the winter.

[Beef cattle experiments at the Montana Station], C. N. Arnett (*Montana Sta. Rpt. 1921, pp. 33, 34*).—Experiments in beef cattle feeding are reported in continuation of the previous year's work (E. S. R., 46, p. 364).

Winter feeding of grade beef calves.—The complete results of four years' work on this experiment indicate that alsike clover and timothy hay mixed are slightly superior to alfalfa hay alone as the only feed for wintering beef calves. It was found unnecessary under ordinary conditions to feed any grain to calves to be put on grass the following spring, as the grain made the calves too fat for economical gains on pasture. Calves wintered on alfalfa hay and

sunflower silage made slightly greater gains on pasture than others wintered on alfalfa hay only. There was practically no difference, however, in the total winter and summer gains in either case.

Winter feeding beef cows.—Several experiments have shown that beef cows in good condition in the fall may be satisfactorily wintered on good straw and produce strong calves. When the cows were thin in the fall it was necessary to add cottonseed meal or hay or both to the ration.

Feeding sheep [at the Montana Station], C. N. ARNETT (*Montana Sta. Rpt. 1921, p. 38, fig. 1*).—In a 73 to 80-day test with pregnant ewes it was found that the following rations are approximately equal in value: 4.06 lbs. of alfalfa hay, 2.84 lbs. of alfalfa hay and 3.83 lbs. of sunflower silage, and 2.03 lbs. of alfalfa hay and 5.7 lbs. of sunflower silage. The ewes of 1 lot receiving daily rations of 0.5 lb. oat straw, 5.54 lbs. of sunflower silage, and 0.21 lb. of cottonseed cake were not as thrifty in appearance, but lambed practically as well as others receiving the above rations.

Sheep production in Chile (*Dir. Jen. Serv. Agr. [Chile] Bol. 68 (1921), pp. 80, figs. 16*).—The general conditions of sheep management, breeding, housing, feeding, care, etc., as especially applied to conditions in Chile, are briefly discussed.

The production of the Corsican breed of sheep, L. BOYER and P. SAJOUS (*Sur l'Amélioration de la Race Ovine Corse. [Ajaccio]: Off. Agr. Dept. Corse, 1922, pp. 43, figs. 5*).—This is a general discussion of sheep production in Corsica, with reference to the establishment of the native breed. It is reported that these animals produce milk of excellent quality and in rather large quantities. The rules governing the breeding and registry of the animals are also given.

The selection of rams for studs and flocks, W. S. VAN HEERDEN (*Union So Africa Dept. Agr. Jour., 6 (1923), No. 2, pp. 151–162, figs. 6*).—The qualities to be considered in selecting rams for studs and for flocks are discussed, and reference is given to the methods of managing sheep in the Union of South Africa.

Sheep breeding for export, O. RIVERS (*Union So. Africa Dept. Agr. Jour., 5 (1922), No. 4, pp. 330–336, fig. 1*).—The development of the frozen meat trade in Australia, New Zealand, and South Africa is briefly reviewed, and the possibilities for future development in South Africa are outlined. The poor quality of the carcasses produced and the difficulties of sheep breeding have handicapped the trade in the past.

In breeding experiments carried on at the Potchefstroom School of Agriculture, 26 Blackhead Persian, 65 Suffolk-Persian crossbreds, and 23 Suffolk-Merino crossbred ewes were mated with 2 Suffolk rams. The resulting 119 lambs which were successfully raised produced a good grade of carcasses, and the lambs were fairly resistant to the bont-legged ticks which are prevalent in the region. It was necessary, however, to dip the lambs and to use extra medicine when tick infestations were severe.

It is suggested that crossbreds sired by Suffolk rams be produced in the future, which should result in successful building up of the frozen meat trade in South Africa.

Return of sheepowners [of New Zealand, 1921–1922 reports] (*New Zeal. [Dept. Agr.] Return of Sheepowners, 1921–1922, pp. 176*).—This gives the number of sheep on the farms of each sheepowner in New Zealand on April 30, 1921, and on April 30, 1922.

Feeding tests with hogs [at the University of Hawaii], L. A. HENKE (*Hawaii Univ. Quart. Bul., 2 (1923), No. 1, pp. 29–40*).—The following feeding experiments carried on at the University of Hawaii are briefly reported:

[*Comparison of the rate of gain of purebred Berkshire and Berkshire-Tamworth crossbred pigs and the kind and amount of feeds selected by them from self-feeders.*]—The litters of two Berkshire sows were compared as to rate of gain and kind of feed consumed from self-feeders. One of the litters was sired by a Berkshire boar and the other by a Tamworth boar. The Berkshire litter consisted of 6 pigs, whereas there were 8 pigs in the crossbred litter. The dates of birth were, respectively, April 4 and April 2, 1921. From July 8 to September 23 all pigs were fed in the same lot on self-feeders containing separate feeds in each feeder so that the pigs were allowed to balance their own rations.

In the first half of the test the ration chosen consisted of 29 per cent of green alfalfa, 34 per cent of roots, and 37 per cent of concentrates, whereas in the second half of the test the selected ration consisted of 22 per cent of green alfalfa, 27 per cent of roots, and 51 per cent of concentrates. Corn and wheat middlings made up over 55 per cent of the concentrates in each part of the test, the greater part of the balance consisting of barley and oats. During the test the crossbred pigs made average daily gains of 1.1 lbs. per pig, whereas the purebreds made gains of 0.61 lb. One of the crossbred pigs died 3 days before the completion of the trial. The most rapid gains were made from the twentieth to the twenty-fifth week of age, but the more economical gains were made from the fourteenth to the nineteenth week of age.

Cassava meal v. cassava molasses meal v. dried pineapple waste as a feed for growing and fattening hogs.—Three lots of 7 Berkshire pigs each received rolled barley, cracked corn, wheat middlings, and tankage in separate self-feeders and equal amounts of green alfalfa daily. In addition lots of 1, 2, and 3 received, respectively, cassava meal, cassava molasses meal, and dried pineapple waste in another self-feeder. The dried pineapple waste consisted of 17.82 per cent of water, 3.65 of protein, 0.49 of ether extract, 60.04 of nitrogen-free extract, 13.25 of fiber, and 4.75 per cent of ash. During the 12 weeks' test average daily gains of 1.11 lbs., 1.03, and 0.98 lb. per pig were made by lots 1, 2, and 3, respectively.

The concentrated ration of lot 1, as balanced by them, consisted of 17 per cent of rolled barley, 28 per cent of cracked corn, 21 per cent of cassava meal, 20 per cent of middlings, and 14 per cent of tankage. The mixture consumed by lot 2 was very similar to this except for the substituted feed, but in lot 3 the pineapple waste made up only 9 per cent of the concentrates and the corn consumption was increased to make 41 per cent of the ration. In lot 1 it required 3.47 lbs. of concentrates to produce 1 lb. of gain. In lot 2, 3.79 lbs. and in lot 3, 3.53 lbs. of concentrates were required to produce a pound of gain.

Dried pineapple waste as a hog feed.—Two lots of 8 Berkshire pigs each were used for this test which lasted 6 weeks. Lot 1, receiving feeds in separate self-feeders, balanced their own ration so that it consisted of 5 per cent of dried pineapple waste, 30 per cent of rolled barley, 10 per cent of cassava meal, 29 per cent of wheat middlings, 15 per cent of cassava molasses meal, and 11 per cent of tankage. In addition the pigs received 405 lbs. of green alfalfa. During the test they made average daily gains per pig of 0.69 lb., consuming 3.71 lbs. of feed per pound of gain.

Lot 2 was self-fed for 3 weeks on a grain mixture consisting of dried pineapple waste, wheat middlings, rolled barley, tankage, and coconut meal in the proportion of 3:3:2:1:1. In addition the pigs ate 241 lbs. of green alfalfa and made average daily gains of 0.9 lb. per pig, consuming 4.07 lbs. of grain per pound of gain. At the end of the 3 weeks' test period the grain mixture was changed to consist of dried pineapple waste, wheat middlings, tankage, and coconut meal in the proportions of 5:3:1:1 for a second 3 weeks' test, 141

lbs. of green alfalfa being consumed during this period. Average daily gains of 1.08 lbs. per pig were made, and 3.7 lbs. of grain were required to produce 1 lb. of gain. Though the hogs would not voluntarily eat much of the pineapple waste, fairly good gains were made with it when it made up 30 to 50 per cent of the grain mixture. The hogs on these mixtures were not in particularly good condition at the end of the test, and 1 died of double pneumonia after the conclusion of the experiment, while 2 others were sick.

[Swine feeding experiments at the Montana Station], C. N. ARNETT (*Montana Sta. Rpt. 1921, pp. 36–38, fig. 1*).—A number of swine feeding experiments are reported.

Supplemental feeds for swine.—Four lots of hogs were self-fed on the following rations: Lot 1 barley (ground hull-less), lot 2 barley and tankage, lot 3 barley 93 per cent and tankage 7 per cent, and lot 4 barley and whole alfalfa hay. The best gains were made by the pigs in lot 3, closely followed by those in lot 2. Lot 4 produced the most economical gains as determined by feed consumed per pound of gain.

Forage crops for swine.—A continuation of this test (E. S. R., 46, p. 364) has shown very little difference in the rate of gain of pigs receiving barley or barley and tankage on red clover pasture as compared with similar feeds in dry lot.

Methods of feeding on forage.—The results of experiments have indicated that hogs will not do well on limited grain rations on forage until after they weigh 60 to 75 lbs. The time required to reach 200 lbs. on forage is longer than for grain-fed hogs, but the amount of grain necessary is less.

Experiments with hogs [at the Huntley, Mont., Substation], D. HANSEN (*Montana Sta. Rpt. 1921, p. 78*).—In a comparative finishing test, 116 lbs. of No. 2 barley were equal in feeding value to 100 lbs. of No. 3 corn for hogs. In another test it was found more profitable to finish fall pigs as early as possible rather than to hold them over another year. Adding tankage to a corn ration for pigs on alfalfa pasture did not show any particular advantage in the rate of gain.

Hog experiments on the dry land, A. E. SEAMANS (*Montana Sta. Rpt. 1921, pp. 81, 82, fig. 1*).—In studying the feeding value for hogs of certain dry land pastures, 1 acre of winter rye carried 10 fall pigs for 36 days, during which time 984 lbs. of corn were fed. A gain in weight of 286 lbs. was made during this period. At the conclusion of this test these pigs were moved to 1 acre of barley, which they cleaned up in 14 days, making a gain of only 21 lbs. Check plats of rye and barley yielded, respectively, 5 and 6.4 bu. of grain per acre.

Alfalfa has been found to be the best pasture. Six pigs pastured on 1 acre of alfalfa, receiving 1,326 lbs. of corn, gained 419 lbs. in 71 days. Five pigs on ¾ acre of brome grass gained 264 lbs. when fed 974 lbs. of corn. Brome grass was not as satisfactory as alfalfa.

The value of a first cross in the production of pork and bacon (*Jour. Min. Agr. [London], 29 (1923), No. 10, pp. 939–941*).—In an experiment at the Lord Wandsworth Institution, England, 9 pure-bred Large Black pigs were compared with 9 Berkshire-Large Black crossbreds as to rate of growth and economy of gain. The crossbreds grew faster and consumed 3.1 lbs of grain per pound of gain, whereas the purebreds required 3.3 lbs. of grain to produce 1 lb. of gain.

Tenth report of cooperative experiments in State supported breeding centers, N. O. HOFMAN-BANG (*Beret. Forsøgslab. K. Vet. og Landbohøjsk. [Copenhagen], 109 (1922), pp. 109, figs. 2*).—In experiments carried on at Bregentved, Over Løjstrup, and Elsesminde from 1917 to 1921 to compare Yorkshire, common Danish, and crossbred swine for export pork production,

it was found that the Yorkshire excels the common Danish breed in the production of bacon and hams and in the fineness of the quality of the meat.

Fire line hay (*La. Planter, 70 (1923), No. 1, pp. 9, 10*).—In a test in Cuba it was found that a horse receiving 7 lbs. of oats per day and fire line hay ad libitum maintained weight practically as well as another horse doing a similar amount of work and receiving grass. The daily ration of the hay was found to be much the cheaper, and it is recommended that more use be made of hay in tropical countries.

Poultry manual, P. Castro Biedma (*Cartilla Avícola. La Plata: Prov. Govt., 1921, pp. 220, pls. 22, figs. 67*).—This is a general book on poultry husbandry, dealing with the breeds, methods of housing, feeding, care, management, and raising of fowls, turkeys, ducks, and geese in Argentina.

Chantecler poultry, L. J. Cole (*Jour. Heredity, 13 (1922), No. 4, pp. 146–152, figs. 3*).—The methods employed in developing the Chantecler breed of fowls at the Agricultural Institute of Oka, located at La Trappe, Canada, are described. M. Wilfrid, who was instrumental in developing the breed, made the first crosses in 1908 between a dark Cornish male and White Leghorn hens and between a Rhode Island Red cock and White Wyandotte hens. In 1910 a White Plymouth Rock cock was mated to the hens of the most desirable type. The process of crossing and selection continued until 1920, when the breed was recognized by receiving a place in the Standard of Perfection of the American Poultry Association.

In developing the breed, it was desired to create a type adaptable to Canadian conditions without paying particular attention to fancy points. The birds of the breed are white, with a minimum of comb and wattles, of a general purpose type, and fairly good egg producers. The contribution of the Cornish is very noticeable in the comb, wattles, carriage, and strong, broad breast.

[Poultry experiments at the Montana Station], W. F. Schoppe (*Montana Sta. Rpt. 1921, pp. 65, 66*).—The progress which has been made in improving the egg production of White Leghorns during eight years is reviewed. The results of a test with artificial light indicated that hens having light from 5 a. m. until daylight were more profitable than those having extra lights in the evening.

Food in relation to egg production, E. J. Davey (*Jour. Min. Agr. [London], 29 (1922), No. 8, pp. 745–748, pl. 1*).—Based on the egg-laying contests at the Harper Adams Agricultural College, England, carried on from November, 1919, to October, 1921, the relation of the average cost of food per month to the value of the eggs produced is discussed and presented graphically. The costs of feed were high because the purpose of the egg-laying contest is to get maximum production, and in some cases the feeds used are of better quality than necessary.

Poultry feeding, A. Owen-John (*Union So. Africa Dept. Agr. Jour., 6 (1923), No. 2, pp. 176, 177*).—In a test carried on at the Grootfontein School of Agriculture, Union of South Africa, to compare wet and dry mash for egg production, 2 lots of 14 White Leghorn pullets each received mash consisting of wheat bran and pollards plus 20 per cent meat scrap and 0.5 per cent of salt, together with a grain mixture of 2 parts of oats and 1 part of yellow corn. The birds of one lot received the mash dry and the birds of the other lot received 2 oz. per bird per day mixed with water.

The total yearly egg production of the wet-mash lot was 2,099 and of the dry-mash lot 2,529 eggs. During the four winter months the wet-mash lot laid 141 eggs as compared with 428 by the dry-mash lot. The dry-mash pen consumed 24 lbs. more mash, but the size and hatchability of the eggs from this pen were better than from the pen receiving wet mash.

The influence of proteins on the nutrition of chickens, H. MALABSKI (*Pam. Państ. Inst. Nauk. Gosp. Wiejsk. Puławach (Mém. Inst. Natl. Polonais Écon. Rurale Puławy), 1 (1920), A, No. 1, pp. 58–65*).—To determine the most desirable food for baby chicks, analyses were made of the yolks remaining in an egg after 20 days of incubation, and it was found that the ratio of protein to fats and lecithins was 1.6:1.74. It is suggested that the feeds for baby chicks should be in agreement with this ratio. Feeding experiments which have been carried out by the author seem to bear out this conclusion. The work is briefly summarized in English.

Observations on the use of nettle in feeding poultry, A. MOLLO (*Staz. Sper. Agr. Ital., 55 (1922), No. 10–12, pp. 490–496*).—The air-dried nettle was found to consist of 88.6 per cent of dry matter, containing 18.3 per cent of protein, 7.7 of fat, 38 of nitrogen-free extract, 10.6 of fiber, and 14 per cent of ash. The feeding value of nettle was compared with that of crimson clover in an experiment with 2 lots of 6 cockerels each, which lasted 63 days. One lot of cockerels consumed 10.3 kg. of bran, 5.4 of nettles, and 9.8 kg. of corn, the total ration having a starch value of 15.72 kg., whereas the other lot consumed 10.3 kg. of bran, 5.4 of crimson clover, and 9.8 kg. of corn having a starch value of 14.92 kg.

The first lot made average gains in the test of 0.537 kg. per head, as compared with gains of 0.499 kg. for the second lot. At the start of the test the average weight of the birds in the respective lots were 0.232 and 0.25 kg. The author concludes that nettle has shown itself to be superior to crimson clover for growth and development of cockerels.

New York City egg prices and what they mean to the poultry raisers of New Jersey, H. KELLER, JR. (*New Jersey Stas., Hints to Poultrymen, 11 (1923), No. 6, pp. 4*).—In this address the importance of the New York City egg market as determining the prices for eggs received by New Jersey poultry raisers is emphasized.

DAIRY FARMING—DAIRYING.

[Experiments with dairy cattle at the Montana Station], C. N. ARNETT (*Montana Sta. Rpt. 1921, pp. 34–36*).—The results of the following experiments with dairy cattle are reported:

Relative value of timothy hay and sunflower silage in feeding dairy cows.—In a 70-day test 1 lot of cows fed an average of 13.25 lbs. of timothy hay and 45.05 lbs. of sunflower silage per day produced 1.23 lbs. more milk and 0.083 lb. more butter fat daily per cow than another lot receiving 29.13 lbs. of timothy hay as their only roughage. Both lots received equal amounts of a grain mixture.

The self-feeder for dairy calves.—Dairy calves receiving grain in amounts which they would consume in 15 minutes made average daily gains of 2.07 lbs., as compared with gains of 1.78 lbs. by calves receiving the same grain ration in self-feeders. Equal amounts of skim milk and hay in a rack at all times were fed in addition to the grain mixture. The hand-fed calves consumed more hay but only about one-half as much grain and less skim milk than the calves on the self-feeders.

Soiling v. pasture for dairy cows.—One lot of 4 cows was fed for 76 days on 134 lbs. of green feed daily per cow in addition to grain and produced 9,211 lbs. of milk and 316 lbs. of butter fat, while a like number of cows receiving the same amount of grain, together with pasture, produced 9,697 lbs. of milk and 346.5 lbs. of fat. There was required 0.48 acre for producing the green feed and 0.7 acre for producing the pasture, but the pasture was not entirely

used during the test. On the acre basis it was calculated that 1 acre of pasture would support 4 cows for 137 days and would produce 17,322 lbs. of milk and 628.5 lbs. of butter fat, while 1 acre of soiling crops would support 4 cows for 142 days and produce 18,422 lbs. of milk and 632 lbs. of butter fat.

Skim milk for dairy cows.—In an 84-day experiment in which approximately 20 lbs. of skim milk were fed per head as a supplement to dairy cows, it was shown that for such feeding skim milk has a value of about 25 cts. per hundred when hay is valued at $15 per ton, grain at $1.50 per hundred, and silage at $6 per ton.

Calf rearing, J. M. KERR (*Jour. Dept. Arg. Victoria, 19 (1921), No. 10, pp. 596–600*).—The recommended method of caring for and feeding dairy cows during and after pregnancy is described. The principles of calf feeding are given, and the use of carob bean pods (*Ceratonia siliqua*) ground into a meal and mixed with linseed meal, ground linseed, and wheat flour to form a gruel is recommended.

The economics of winter and summer milk production, J. WYLLIE (*Jour. Min. Agr. [London], 29 (1923), No. 10, pp. 894–904*).—The systems of milk production are classified into four groups, (1) milk selling, (2) milk selling and cheese making in the seasons of surplus, (3) butter making, and (4) cheese making. It was determined that the system to follow depends on the relative prices of milk and the costs of production in each case during the different seasons.

Effect of age and stage of lactation on yield, A. C. RAGSDALE and C. W. TURNER (*Jersey Bul. and Dairy World, 42 (1923), No. 16, pp. 773, 774, 804*).—The data previously noted by the junior author (E. S. R., 48, p. 874) are given, and in addition the relative monthly milk production during the successive months of lactation is tabulated as was previously done for the fat percentage (E. S. R., 48, p. 78). A combined table showing the relative production of cows of different ages and during different months after freshening is also given.

[The physiology of milk secretion], I, II, O. ZIETZSCHMANN (*Deut. Tierärztl. Wchnschr., 31 (1923), No. 10, pp. 109–114*).—The two following papers dealing with the physiology of milk secretion in dairy cattle are presented:

I. *Milk secretion and milk flow in the cow.*—The author has divided milk secretion into two phases; i. e., that which occurs between the periods of milking and the secretion occurring at the time of milking which is instigated by manipulation of the udder due to the process of milking. After a cow is milked out the udder feels empty and flabby and the teats are wrinkled and relatively small. Soon after milking, the udder gradually fills again, becoming larger, and the skin becomes tighter. The teats gradually swell and become stiff and full as the pressure from the milk increases. The cavities in the udder and teats become entirely filled with milk and the swelling of the cells. The maximum of the udder swelling is undoubtedly accompanied by arterial hyperemia. The milk is held in the udder by the action of the sphincter muscles.

In the second phase of milk secretion, the act of milking causes a contraction of the muscular walls of the corpus cavernosum which forces the milk into the cavities of the teats. As the milk is drawn from the teats other milk is secreted into the canals as a result of the manipulation of the udder. This secretion gradually ceases toward the end of milking.

II. *The drawing of the milk of the cow.*—This is a discussion of the process of milking, with special reference to the ability of certain cows to hold back their milk, two main causes of which are given as nervousness or strange conditions and pain in one or more of the teats during milking.

Studies in milk secretion.—[XIII], Relation between milk yields and butter-fat percentages of the 7-day and 365-day tests of Holstein-Friesian Advanced Registry cattle, M. S. and J. W. GOWEN (*Maine Sta. Bul. 306 (1922), pp. 21–60*).—This is a more complete report of the study of which an abstract was previously given (E. S. R., 48, p. 478).

A report of an investigation of the milk of individual cows, P. V. F. P. LANGMACK (*Beret. Forsøgslab. K. Vet. og Landbohøjsk. [Copenhagen], 107 (1921), pp. 160+7, figs. 8*).—This investigation, which was carried on at 19 different experiment stations in Denmark, deals with the yearly milk and fat records of individual cows of three Danish breeds and compares them with records of Holsteins, Ayrshires, and Jerseys. The report has been divided into four parts.

A. *Quantity of milk and fat produced by different strains or breeds.*—Yearly milk and fat records of 130 Angler, 144 Fünen, 78 Jutland, 20 Holstein, 13 Ayrshire, and 40 Jersey cows were collected, based on 10 lactation periods for most of the animals. The following table shows the average yearly milk and fat production and fat percentage for each breed as determined from the individual records:

Average yearly milk and fat production of different breeds of cattle.

Breed.	Milk production.	Fat percentage.	Fat production.
	Kg.	*Per cent.*	*Kg.*
Angler	3,284±217	3.276±0.045	107.5±7.2
Fünen	3,128±212	3.396± .059	106.1±7.4
Jutland	3,272±218	3.381± .042	110.4±7.5
Holstein	3,198±222	3.362± .059	102.3±7.7
Ayrshire	2,607±105	3.679± .045	96.1±4.1
Jersey	2,458±163	5.068± .069	123.9±8.4

B. *Milk and fat production during the first ten lactation periods.*—Based on the milk and fat records of the first 10 lactation periods of 109 Angler, 116 Fünen, 67 Jutland, 17 Holstein, 5 Ayrshire, and 39 Jersey cows, the average changes in milk and fat production in succeeding lactation periods for the individual cows of each breed were determined. Considering the average production of the cows for the 10 lactation periods as 100, the following table shows the relative average production of the three Danish breeds during each period of lactation:

Percentage production for three Danish breeds during the first ten lactation periods, based on the average for all lactation periods.

Production.	Lactation period.									
	First.	Second.	Third.	Fourth.	Fifth.	Sixth.	Seventh.	Eighth.	Ninth.	Tenth.
	Per ct.	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
Milk production	70.1	83.8	94.4	102.2	107.4	110.2	111.0	110.0	107.4	103.5
Fat percentage	103.7	102.4	101.2	100.4	99.7	99.2	98.8	98.5	98.2	97.9
Fat production	72.9	86.0	95.8	102.8	107.3	109.5	109.9	108.5	105.7	101.6

C. *Correlation between fat and milk production.*—Based on the records used in Part A of this study, the correlation between the amounts of milk and fat produced by cows of the different breeds was calculated and found to be negative.

D. *The mathematical basis for calculating correlations.*—The method of calculating coefficients of correlation is described, and the theory by means of which the coefficients are determined is given.

Tables showing detailed results of the individual animals, and a supplement showing the calculated production of 2 cows during 10 lactation periods, are included in the work.

Comparison of the milk from Polish Red cows and Polish Whitebacks, H. Malarski (*Pam. Państ. Inst. Nauk. Gosp. Wiejsk. Puławach* (*Mém. Inst. Natl. Polonais Écon. Rurale Puławy*], *2* (*1922*), *A*, *No. 2*, *pp. 250–253*).—The composition of the milk of the Polish Red cows and Polish Whitebacks is compared.

The milk of Corsican ewes, L. Boyer and P. Sajous (*Ann. Falsif., 15* (*1922*), *No. 169*, *pp. 402–405*).—This is an extract from the work noted on page 168, showing analyses and data as to the quantity of milk produced by Corsican ewes.

Note on the nonprotein nitrogen in goat's milk, W. Taylor (*Biochem. Jour., 16* (*1922*), *No. 5*, *pp. 611*, *612*).—To study the effects of certain factors on the amount of nonprotein nitrogen in goat's milk, a goat was fed during 7 periods of from 8 to 16 days each on variable rations at the Rowett Institute, Aberdeen. Determinations were made of the amounts of urinary nitrogen excreted and the total protein, caseinogen, albumin, and globulin in the milk, from which the amount of nonprotein nitrogen in the milk was calculated. It was found that on the high protein diets nonprotein nitrogen occurred in the milk in amounts of 0.37 to 0.39 per cent, and on lower protein diets the amount decreased to 0.16 per cent when a high carbohydrate ration was fed. When large amounts of nonprotein nitrogen occurred in the milk, corresponding amounts of urinary nitrogen were also excreted, the amounts of each apparently being determined by the amount of protein in the feed.

The knowledge of milk, M. Fouassier (*La Connaissance du Lait. Paris: J.-B. Baillière & Son, 1922, pp. 136, figs. 16*).—This is an elementary book prepared from a course of lectures dealing briefly with the composition of milk, bacteria, pasteurization, the manufacture of powdered milk, and the different methods of testing milk.

Aids in the production of clean milk, W. J. Butler (*Mont. Live Stock Sanit. Bd. Labs. Contrib., 1* (*1923*), *No. 6*, *pp. 16*, *figs. 12*).—This is to emphasize the most important considerations for the production of clean milk. A large part of the work consists of diagrams of dairy barns, farm milk houses, and methods of cooling milk.

Cleaning milking machines, L. H. Burgwald (*U. S. Dept. Agr., Farmers' Bul. 1315* (*1923*), *pp. 16*, *figs. 13*).—The necessity of proper sterilization of milking machines is emphasized by giving the results of tests on farms showing the bacterial content of the milk where the milking machines were sterilized by heat and where they were sterilized by other methods. The method of cleaning and sterilizing milking machines and utensils by heat is described with the aid of a series of illustrations.

Proposed milk ordinance for the use of local boards of health, W. W. Scofield (*Milk Dealer, 12* (*1923*), *No. 7*, *pp. 54*, *56*, *61*).—A proposed milk ordinance which might be adopted by local boards of health as a model is given.

Proceedings of the eleventh, thirteenth, fourteenth, fifteenth and sixteenth annual conferences of the American Association of Medical Milk Commissions in conjunction with the Certified Milk Producers' Association of America (*Amer. Assoc. Med. Milk Comns. Proc., 11, 13–16* (*1917, 1919–1922*), *pp. XII+550*, *figs. 26*).—The proceedings of the annual meetings of these

two societies, held in 1917 and from 1919 to 1922, are reported. The papers deal with the methods of producing certified milk and milk of low bacterial counts, milk as a carrier of disease, and the food value and vitamin content of milk. Previous reports have been noted (E. S. R., 36, p. 572).

Acidity of butter, F. W. Bouska (*N. Y. Prod. Rev. and Amer. Creamery, 55 (1923), No. 20, pp. 964, 966*).—To keep the acidity of butter at a minimum, it is suggested that churning conditions be controlled so that the butter granules formed will be the size of wheat. Since the acidity of butter is about one-half due to the buttermilk which it contains, the butter granules should be thoroughly washed before working, possibly followed by working under water in order that as much adherent buttermilk as possible be removed from the product.

Fishy flavor in butter, M. C. Johnstone (*Hoard's Dairyman, 65 (1923), No. 12, p. 446*).—Studies at the University of Wisconsin have shown that fishy flavor in butter is due to lecithin combining with air to form cholin, which then decomposes, one of the products being trimethylamin. Oxidation of the lecithin in the cream or preventing its oxidation in the butter will prevent the fishy flavor. Pasteurizing the cream at 145° F. for 30 minutes will oxidize most of the lecithin in it. "The acidity of the cream, the tinning of the utensils, the salting and working of the butter, and the storage all affect the possibility of odor after the butter is made, since all act as oxidizing agents." Copper and iron in the butter tend to act as catalytic agents for the oxidation of the lecithin, and salt helps oxidation and holds the undesirable flavor in the butter.

Variations in the bacterial content of stored butter, G. Dalla Torre (*Ann. Ist. Sper. Caseif. Lodi, 1 (1922), No. 5–6, pp. 169–198, figs. 2*).—Bacteriological determinations of samples of butter stored for different periods in refrigerators indicate that during the first part of the storage period the plate counts gradually increase to a high point at from 3 to 14 days, followed by gradual decreases to the end of the storage period.

The relationship of bacteria to the quality of Cheddar cheese, J. K. Murray (*Agr. Gaz. N. S. Wales, 33 (1922), No. 12, pp. 867–876, fig. 1*).—The types of bacteria in Cheddar cheese are the biggest factors in determining its quality. The basic organism for the production of the proper aroma is of the *Streptococcus lacticus* group, but it should be associated with other types. Types causing fermentation, such as *Bacillus lactis aerogenes, B. coli communis,* and *B. acidi lactici,* are undesirable and should be guarded against. The temperature at which the milk is kept, the care and production, handling, and pasteurization have a great deal to do with the prevalence of different types of bacteria, favorable and unfavorable to cheese production.

The ripening of cheese, Orla-Jensen (*Lait, 1 (1921), No. 10, pp. 493–501*).—This is a discussion of the complexities of cheese ripening which are due to the protein, fatty, and carbohydrate decomposition caused by different organisms acting under varying conditions.

The production and marketing of Ontario cheese, R. D. Colquette and B. G. Jenvey (*Ontario Dept. Agr. Bul. 291 (1922), pp. 24, figs. 2*).—This is a survey of cheese production in Ontario which was made by an accumulation of records on the production in 112 cheese factories during 1921.

The factories producing the larger amounts of cheese produced it at a much lower cost and received a better price for it than the smaller factories, indicating that it was of better and more uniform quality. It is suggested that the smaller factories unite with others to increase the efficiency of their production. The relative costs of milk hauling seemed to depend upon the amount of milk that was collected per route.

Data as to the amount of cheese produced and exported from Ontario and Canada are presented, and a discussion of the cost and method of transportation is given.

Gelatin, viscosity, and melting resistance, V. C. MANHART (*Ice Cream Trade Jour., 19 (1923), No. 4, pp. 61, 62; also in Ice Cream Rev., 6, (1923), No. 12, pp. 8, 112*).—In experiments at the Purdue Experiment Station samples of ice cream containing 8 per cent of fat and 34 per cent of total solids were prepared with the addition of 0.6 per cent of gelatin graded as poor, good, and very good. Another sample of ice cream was made without gelatin. Tests were made of the viscosity of the mix as compared with water at 15° C. (59° F.) and the amount of melting which occurred in a room at 86° F. was determined. The following table gives a summary of the results:

Effect of different qualitied gelatin on viscosity and melting resistance.

Kind of gelatin.	Viscosity of mix, compared with water as 1.	Increase in viscosity	Ice cream melted at 86° F. after—					
			30 minutes.	40 minutes.	50 minutes.	60 minutes.	90 minutes.	120 minutes.
		Per ct.	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
None	1.67	.....	9.80	16.66	26.46	33.32	55.38	71.55
Poor quality	4.09	144.9	5.55	14.43	26.65	38.87	75.53	95.53
Good quality	10.90	522.6	.26	2.86	12.23	24.13	64.75	90.79
Very good quality	15.60	834.1	.26	2.35	8.60	19.05	55.95	85.22

Report on milk production and manufactured dairy products in New York State for year 1921 (*N. Y. State Dept. Farms and Markets, Agr. Bul. 145 (1922), pp. 89*).—A list of the dairies operating in New York State during 1921, and the amount of milk handled and dairy products manufactured by these plants, are reported.

VETERINARY MEDICINE.

Experimental bacteriology and infectious diseases, I, II, W. KOLLE and H. HETSCH (*Die Experimentelle Bakteriologie und die Infektionskrankheiten. Berlin and Vienna: Urban & Schwarzenberg, 1922, 6. ed., rev., vols. 1, pp. XVIII+636, pls. 41, figs. 86; 2, pp. XI+637–1376, pls. 73, figs. 140*).—This is the sixth revision of the volumes previously noted (E. S. R., 44, p. 678.)

The herd diseases of domestic animals caused by animal parasites, R. DISSELHORST (*Die Herdekrankheiten unserer Haustiere, Hervorgerufen Durch Tierische Parasiten. Berlin: Paul Parey, 1921, pp. 108, figs. 84*).—This is a summary of information on the affections caused by animal parasites.

Atlas of parasitology, P. HAUDUROY (*Atlas de Parasitologie. Paris: Libr. Octave Doin, 1923, pp. 53, figs. 381*).—This consists of plates with illustrations of parasites of animals.

Contribution to the knowledge of the anatomical lesions caused by Eustrongylus gigas (Dies.), L. LEANATI (*Clin. Vet., Rass. Polizia Sanit. e Ig. [Milan], 45 (1922), No. 15, pp. 629–638, figs. 3*).—This report of histopathological studies by the author includes a bibliography of 36 titles.

Plants poisonous to stock and first aid, E. W. FENTON and C. MASSON (*Seale-Hayne Agr. Col. Pamphlet 5, pp. 16, figs. 4*).—A brief summarized account of the more important poisonous plants in the southwest of England.

Alleged sweet clover poisoning: Its relation to hemorrhagic septicemia, L. H. Pammel (*Vet. Med., 18 (1923), No. 3, pp. 245–247*).—The literature relating to this subject is reviewed and quoted from by the author.

Staggers or shivers in live stock, S. Dodd and M. Henry (*N. S. Wales Dept. Agr., Sci. Bul. 23 (1923), pp. 24*).—This is a report of studies of an enzootic noncontagious affection of horses, cattle, and sheep occurring in certain parts of New South Wales. The author concludes that it is an intoxication resulting from the ingestion of certain plants, two, at least, having been proved to be capable of producing the condition experimentally, namely, *Malva parviflora* and *Lamium amplexicaule.*

Blood transfusion in domestic animals, L. Panisset and J. Verge (*Rev. Gén. Méd. Vét., 31 (1922), No. 368, pp. 441–467, figs. 7*).—The authors describe the technique which they employ in blood transfusion in large domestic animals (horses, cattle, etc.) and in small animals such as dogs; outline briefly the accidents sometimes resulting from blood transfusion, with suggestions for avoiding such accidents; and, in conclusion, discuss the pathological conditions in which transfusion may be used to advantage.

Live stock disease control (*Mich. Dept. Agr. Ann. Rpt., 1 (1922), pp. 70–91, figs. 2*).—This report gives the details of bovine tuberculosis eradication work, hog cholera control, etc., together with regulations signed by the commissioner of agriculture relating to the work.

Biennial report of the Minnesota State Live Stock Sanitary Board from July 1, 1920, to June 30, 1922 (*Minn. State Live Stock Sanit. Bd. Bien. Rpt. 1921–22, pp. 41*).—This includes accounts of the occurrence of and control work with infectious diseases of live stock.

Some results from the veterinary department, H. Welch (*Montana Sta. Rpt. 1921, pp. 67, 68*).—Work with loco eradication is briefly referred to, and it is stated that the red or purple loco (*Aragallus blankenshipii*) proved to be entirely harmless to sheep and is thought to be harmless to other stock. In a flock of 50 Angora goats goiter was observed in 45, about one-half of the kids in the flock having died from the affection each spring. It was found that tincture of iodin applied externally on the necks of the goats resulted in the complete disappearance of the goiter. Progressive pneumonia of sheep, or the so-called "lunger" disease, has been definitely determined to be infectious. Cultures from the lungs of affected sheep from many different bands showed the presence of a short rod-shaped bacillus in nearly every case.

Report of the New York State Veterinary College at Cornell University for the year 1921–22 (*N. Y. State Vet. Col. Rpt., 1921–22, pp. 172, pls. 19*).—The papers included in this report are as follows: Autopsies, by S. A. Goldberg and L. B. Sholl (pp. 42, 43); Report of Poultry Disease Investigation, July 1, 1921, to June 30, 1922, by J. W. Fuller (pp. 44, 45); Interpretation of Diseases of the Nervous System, by D. H. Udall, E. R. Cushing, and M. G. Fincher (pp. 46–53); Surgical Diseases of the Udder, by J. N. Frost (pp. 54–61); Local Anesthesia, by H. J. Milks (pp. 62–67); A Study of Some Factors Influencing Fertility and Sterility in the Bull, by H. L. Gilman (pp. 68–126); The Pathological Tissue Changes Resulting from Continuous Feeding of Cottonseed Meal, by Goldberg and L. A. Maynard (pp. 127–131); The Lesions in Necrobacillosis, by Goldberg (pp. 132–134); The Principles of Bovine Mastitis, by J. R. Varley (pp. 135–154); Vaccination in the Control of Chicken Pox, by Fuller (pp. 155–161); and Further Study of a Parasite Found in the Ligamentum Nuchae of Equines, by E. A. Caslick (pp. 162–167).

Annual report of proceedings under the Diseases of Animals Acts, the Markets and Fairs (Weighing of Cattle) Acts, etc., for the year 1921,

S. Stockman (*Min. Agr. and Fisheries [London], Ann. Rpt. Proc. Diseases Anim. Acts, 1921, pp. 106*).—This is the usual annual report (E. S. R., 46, p. 773) dealing with the occurrence of and control work with foot-and-mouth disease, rabies, hog cholera, glanders, anthrax, sheep scab, parasitic mange, epizootic abortion in cattle, etc.

[Diseases of animals in Tasmania], T. Philp and R. A. Black (*Tasmania Dept. Agr. Buls. 107 (1922), pp. 15; 108, pp. 8, figs. 3; 109, pp. 2*).—These bulletins deal, respectively, with the common diseases of dairy cattle and their treatment; with the ragwort (*Senecio jacobaea* L.); and with osteomalacia in cattle.

Paths of infection by Bacterium abortus in rabbits, guinea pigs, and mice, E. S. Sanderson and L. F. Rettger (*Jour. Infect. Diseases, 32 (1923), No. 3, pp. 181–186*).—The results are reported of attempts to infect guinea pigs, mice, and rabbits with *B. abortus* by mouth and guinea pigs and rabbits through the vagina and urethra. In all 9 different strains of the organism were used, including some old strains and some recently isolated. In general an old and a new strain were used in each experiment. The organism was grown on 1.5 per cent agar containing Fairchild's peptone and adjusted to pH 6.9 or 7. At varying intervals after receiving the organism the animals were killed and their sera tested by agglutination and complement fixation tests, using the technique of Gibbs and Rettger (E. S. R., 44, p. 480).

Contrary to the results reported by Rettger, White, and Chapman for cattle (E. S. R., 47, p. 386), guinea pigs, rabbits, and mice proved highly susceptible to infection by *B. abortus* by mouth, vagina, and urethra, as judged by the agglutination and fixation tests and in some cases by the death of the experimental animal. The mating of previously unexposed with artificially infected and reacting animals gave negative results. Young mice suckling an artificially infected mother showed positive agglutination tests, although none of the organs gave evidence of *B. abortus* infection.

Experiments on the feeding of embryonated eggs of Ascaris megalocephala to domesticated animals, T. Goodey (*Ann. Appl. Biol., 10 (1923), No. 1, pp. 116–121*).—The author finds that larvae of *A. megalocephala* are capable of causing fatal pneumonia to mice in their migratory course through the lungs. Attempts to cause pulmonary disturbance in lambs by feeding them with embryonated eggs of *A. megalocephala* proved unsuccessful, and it appears that lambs are not susceptible to such infection.

An attempt to induce heredity transmission of dourine, L. Nattan-Larrier (*Bul. Soc. Path. Exot., 14 (1921), No. 5, pp. 273–277; abs. in Internatl. Inst. Agr. [Rome], Internatl. Rev. Sci. and Pract. Agr., 12 (1921), No. 9, p. 1163*).—In the experiments here reported it was found that neither in the mouse nor in the rat did *Trypanosoma equiperdum* pass through the placental tissue to the fetus. The disease contracted by the mother, however, frequently caused the death of the young mice.

A contribution on the treatment of dourine with Bayer 205, W. Pfeiler and Salfelder (*Tierärztl. Arch., 2 (1922), No. 3–4, Teil A, pp. 162–174*).—The author reports upon the treatment of 16 cases. With the exception of one which succumbed, the symptoms of the disease disappeared from all of the 16 animals treated with Bayer 205 in a remarkably short time and had not reappeared after a period of two years.

Studies in rinderpest, W. A. Pool and T. M. Doyle (*India Dept. Agr. Mem. Vet. Ser., 3 (1922), No. 4, pp. 103–137, pl. 1, fig. 1*).—In this publication the serum alone and serum simultaneous methods of inoculation for the control of rinderpest are discussed in considerable detail from the standpoint of technique,

the results obtained with both methods in India, the nature and duration of the immunity thus secured, and the relative merits of the two methods.

From data reported in the literature and from the author's own experience, it is concluded that a single dose of antirinderpest serum can be relied upon to confer a passive immunity for about 9 days. Increased doses of the serum prolong the immunity, but not in proportion to the increase. It is considered that the method employed in India of placing the serum-inoculated with naturally infected cases is theoretically ideal, but that it has many practical defects which make it dangerous to use. One of the chief drawbacks is that the infection is likely to be present in a herd for some time after the serum protection has disappeared.

The serum simultaneous method, detailed directions for which have been noted from a previous paper (E. S. R., 46, p. 481), is considered the most reliable and economical method for use in countries such as India where the disease is enzootic. Contrary to earlier impressions, it is considered unnecessary to regulate the dose of serum according to the susceptibility of the animal, provided a sufficient dose is given to neutralize the virus injected. It is emphasized that in carrying out the simultaneous inoculation precautions must always be taken that animals already visibly affected with the disease be left uninoculated.

Trypanosoma cruzi in the tissues of the armadillo, B. C. CROWELL (*Jour. Amer. Med. Assoc., 80 (1923), No. 13, pp. 910–912, figs. 3*).—The author reports upon an examination made of an armadillo received at the Oswaldo Cruz Institute in Brazil from Lassance, the center of the endemic zone of Chagas' disease. This armadillo was captured in the wild state and presented a spontaneous infestation with trypanosomes, which were numerous in the peripheral blood, morphologically identical with *T. cruzi*, and infection experiments on guinea pigs have proved their identity with that parasite. The study resulted in the discovery of the insect-transmitted *T. cruzi*, and lesions attributable to it in the heart of the armadillo, indicating that it is essentially a histoparasite in all animals examined, and that it is pathogenic for the armadillo, although this pathogenicity may be slight.

New observations on avian tuberculosis and its bacillus, L. PANISSET and J. VERGE (*Rev. Gén. Méd. Vét., 32 (1923), No. 374, pp. 53–64, figs. 2*).—The first part of this paper consists of a critical analysis of the literature on the unity or plurality of the tubercle bacillus, particularly as concerns avian tuberculosis, the possibility of an exchange of tubercle bacilli from cattle to fowls, etc. This is followed by a discussion of the relative value of bovine and avian tuberculin in the tuberculin test for the detection of avian tuberculosis. Two typical examples are given of the reaction following simultaneous inoculation into the right and left wattles, respectively, of bovine and avian tuberculin. In tuberculous fowls similar reactions are produced in about the same length of time, but the reaction is much more intense with avian than with bovine tuberculin.

Investigations on the value of the complement fixation method for the serum diagnosis of tuberculosis in cattle, using the Besredka antigen, E. GEORGE (*Arch. Wiss. u. Prakt. Tierheilk., 47 (1922), No. 6, pp. 438–445*).—The complement fixation test for the diagnosis of bovine tuberculosis, using the Besredka antigen, was applied to the sera of 92 cattle, the results being classified as strong fixation, weak fixation, and hemolysis. As determined by autopsy findings, 28 animals showed no evidence of tuberculosis, 50 were suffering from glandular and lung tuberculosis, and 14 severe generalized tuberculosis. In these three groups, respectively, there was strong fixation in 3, 10, and 11 cases, weak fixation in 7, 20, and no cases, and hemolysis in 18, 20, and 3 cases.

These conflicting results have led the author to conclude that the complement fixation test is of no value in the diagnosis of tuberculosis in the living animal.

Coccidiosis in cattle in Montana, H. MARSH (*Jour. Amer. Vet. Med. Assoc., 62 (1923), No. 5, pp. 648–652*).—The author reports upon the occurrence of coccidiosis in cattle in a number of places in Montana.

Bovine piroplasmosis in Morocco and its relationship with the piroplasmoses of the Mediterranean Basin, H. VELU (*Bul. Soc. Path. Exot., 14 (1921), No. 2, pp. 116–124; abs. in Internatl. Inst. Agr. [Rome], Internatl. Rev. Sci. and Pract. Agr., 12 (1921), No. 8, p. 987*).—Observations made in Morocco during the past 10 years have been summarized by the author and compared with other records of piroplasmoses in the Mediterranean Basin. It is concluded that circum-Mediterranean piroplasmoses are rarely unmixed diseases, and appear generally to be due to parasitic combinations (*Piroplasma bigeminum—Theileria mutans, P. bigeminum—Anaplasma marginale, T. annulata—T. parva*), which tend to give very diverse clinic types, rendering accurate diagnosis a matter of extreme difficulty, and even impossible in certain cases.

The preparation of braxy vaccine, M. CHRISTIANSEN (*K. Vet. og Landbohøjsk. [Copenhagen], Aarsskr. 1921, pp. 75–90, fig. 1*).—In Iceland and the Faroe Islands protective inoculation against braxy in sheep has been carried out with marked success for a number of years. The method consists in the subcutaneous injection of a mixture of braxy culture containing living spores and braxy immune serum. The former is produced by cultivating the braxy bacillus anaerobically at 37° C. for about 2 weeks in a medium composed of equal parts of glucose-free bouillon and sterile normal horse serum. When the culture contains large quantities of spores it is dried thoroughly and powdered. The immune serum is obtained from horses which have been inoculated intravenously with increasing doses of fresh bouillon cultures of the braxy bacillus (*Bacillus gastromycosis ovis*) until the serum contains a sufficient number of antibodies, as tested by passive immunization experiments on mice and guinea pigs. The serum is then dried and pulverized, in which state it is said to keep active for years. The culture, however, must be prepared fresh every year.

The correct proportions of culture and serum are determined by inoculating a series of guinea pigs simultaneously with mixtures containing a lethal dose for guinea pigs of the culture and varying amounts of serum. For sheep the amount of the culture used is a positively lethal does for guinea pigs, and of the immune serum a slightly smaller quantity than the amount which is just able to protect guinea pigs against this dose of culture. The required amounts of culture and serum are suspended in boiled water and injected subcutaneously. The inoculations are always made in the fall from vaccine prepared during the summer.

Studies on the sheep pox, M. TSURUMI, T. TOYODA, and T. INOUYE (*Japan Med. World, 2 (1922), No. 8, pp. 221–224*).—A report is given of an investigation of an extensive epizootic of sheep pox occurring in Dairen, Manchuria, in a flock of 612 sheep which had been brought there from a province in China. The entire flock contracted the disease, with a subsequent death rate of 43 per cent. The incubation period was from 5 to 12 days, the disease appearing quite suddenly in the majority of cases on the sixth, seventh, or eighth days, with symptoms similar to human and cow-pox. In addition to the cutaneous lesions there were lesions in the lungs, gastrointestinal tract, and lymph glands.

Attempts to transmit the infection by injection in various places of filtered or unfiltered material obtained from the pustules of infected sheep were con-

ducted on sheep, goats, guinea pigs, and rabbits. It was found possible to infect sheep by the inoculation of both filtered and unfiltered material. Goats showed susceptibility in some cases, but guinea pigs and rabbits proved immune.

The unfiltered material remained active after 35 days in the ice box at from 4 to 5° C. (39.2° to 41° F.) and the filtered material for 71 days. The filtered material lost its activity after being treated for 5 minutes with 1 per cent phenol, or 7 minutes with 0.1 per cent mercuric chlorid.

Animals which had recovered from the disease proved immune against subsequent inoculation with the virus. Immunity was also secured in the majority of cases by inoculating the healthy animal in the skin of the under side of the tail with the contents of the vesicles and pustules of an infected animal. A limited degree of protection against subsequent infection with sheep pox virus was secured by inoculation with cowpox vaccine.

In complement fixation tests the sera from convalescent sheep pox cases were positive in 66 per cent of the cases with sheep pox antigen and entirely negative with cow or human pox antigen.

The pyogenic coccus of sheep, H. Carré (*Compt. Rend. Soc. Biol. [Paris], 88 (1923), No. 6, pp. 427, 428*).—The author reports that in 20 samples of pus from subcutaneous abscesses in sheep, one appeared to be sterile, one contained the Preisz-Nocard bacillus only, one the coccus observed in abscesses by Aynaud [1] together with the Preisz-Nocard bacillus, and 17 contained an apparently pure culture of the coccus.

Trypanosomiasis in British sheep, C. A. Hoare (*Roy. Soc. Trop. Med. and Hyg. Trans., 16 (1922), No. 3, pp. 188–194, figs. 11; abs. in Trop. Vet. Bul., 10 (1922), No. 4, pp. 107, 108*).—This is a preliminary account of a trypanosome of the Theileri group, *Trypanosoma melophagium*, which does not appear to be pathogenic for sheep.

The frequence of coccidiosis of the pig (Eimeria brumpti n. sp.) in France, L. Cauchemez (*Bul. Soc. Path. Exot., 14 (1921), No. 10, pp. 645–648, fig. 1; abs. in Internatl. Inst. Agr. [Rome], Internatl. Rev. Sci. and Pract. Agr. 13 (1922), No. 3, pp. 351, 352*).—The author's investigations led to the discovery that intestinal coccidiosis is a disease of very frequent occurrence in swine in France, 26 per cent of the animals examined having been found infected. The disease assumes a mild form in adult pigs, causing no disturbances or lesions. If quite young pigs are attacked by a mild form, they soon recover and become immune to the disease. *E. brumpti* is proposed as a provisional name for the causative agent.

Hookworms in swine, M. C. Hall (*North Amer. Vet., 4 (1923), No. 4, pp. 178–180, fig. 1*).—This brief account includes a key to the hookworms of swine.

On the spirochetes in swine, S. Nomi and T. Matsuo (*Jour. Japan. Soc. Vet. Sci., 1 (1922), No. 3, pp. 149 150, pl. 1*).—The authors report briefly upon spirochetes observed in subcutaneous abscesses, intestinal ulcers, and abscesses of the lungs and of the lymph glands in swine during the course of research work. The organisms observed are divided morphologically into two general groups.

An outbreak of chicken cholera: A bacteriological and hematological study, A. K. Gordon (*Lancet [London], 1923, I, No. 8, pp. 415, 416*).—This is a brief note concerning an outbreak of chicken cholera in a large flock of White Leghorn fowls. A description is given of the macroscopical and microscopical examination of 6 of the fatal cases, particular emphasis being given to the blood picture. A vaccine was prepared from the strain of Pasteurella isolated from

[1] Compt. Rend. Acad. Sci. [Paris], 175 (1922), No. 23, pp. 1170–1172.

2 of the infected birds, and the entire flock of 700 birds was inoculated with an initial dose of 1,000 millions of the killed organism, followed a week later by double the quantity. With the exception of 4 birds which died shortly after the first inoculation, all recovered and there were no further cases of the disease.

Vaccination in the control of chicken pox, J. W. FULLER (*N. Y. State Vet. Col. Rpt., 1921–22, pp. 155–161*).—The literature on vaccination of fowls against chicken pox is reviewed briefly, and the results are reported of the vaccination by the method described by Beach (E. S. R., 44, p. 782) of 9 flocks containing 16,320 fowls.

"Four of the 9 flocks, totaling 5,343 fowls, which were vaccinated before any symptoms appeared, developed no lesions or symptoms. In the 5 other flocks, totaling 10,977 fowls, in which lesions and symptoms had appeared before vaccination, there was a smaller percentage of deaths than there was in the same flock in previous outbreaks and unvaccinated flocks this year. Fowls that had recovered from either natural or artificial attacks of chicken pox remained healthy when placed with birds affected with chicken pox, while susceptible birds died with the disease. The vaccine seems to have more of a preventive than a curative value, although beneficial results were obtained by its use as a curative agent."

The removal of heterakids from the ceca of chickens by rectal injections of anthelmintics, M. C. HALL and J. E. SHILLINGER (*Jour. Amer. Vet. Med. Assoc., 62 (1923), No. 5, pp. 623–630*).—"Experiments to determine the efficacy of rectal injections for the removal of the common heterakid, *Heterakis papillosa*, from the ceca of chickens were carried out as follows: With carbon tetrachlorid in doses of 2 to 10 cc. on 6 birds, with an efficacy of 66.6 per cent; with 1 per cent aqueous solution of copper sulphate in doses of 2 to 10 cc. on 6 birds, with an efficacy of less than 2 per cent; with oil of chenopodium in doses of 0.1 to 1 cc. in 5 cc. of bland oil on 10 birds, with an efficacy of approximately 90 per cent; with turpentine in doses of 0.2 to 1 cc. in 5 cc. of bland oil on 6 birds, with an efficacy of 5 per cent.

"Heterakids can not be removed from the ceca of poultry with any degree of certainty by means of drugs administered by mouth, but can be readily removed by means of rectal injections of oil of chenopodium, given with a hard rubber enema syringe, in doses of 0.1 cc. in 5 cc. of bland oil in the case of birds weighing 1.5 lbs., and double this amount of chenopodium and oil would probably be substantially as effective for adult birds weighing 3 lbs. or more. In view of the damage credited to these worms in massive infestations and of their indicated association with the causative organism of blackhead disease in the production of this disease, the use of the comparatively simple method of treatment by rectal injections for the removal of these worms appears to be warranted."

Observations on the life histories of Hypodaerium conoideum (Bloch) and Echinostomum revolutum (Froel): Trematode parasites of the domestic duck, G. M. VEVERS (*Ann. Appl. Biol., 10 (1923), No. 1, pp. 134–136, fig. 1*).—The author finds that *Limnea peregra* is the intermediate host of *H. conoideum*, the larval form being a cecaria, as yet undetermined, which encysts in some organ of that snail. The flukes reach maturity in the small intestine of the duck in 20 days, and when present in large numbers they cause a considerable inflammatory reaction in the small intestine and may be responsible for a certain amount of debility and wasting. He finds that the encysted larval holostome (*Tetracotyle typica* Dies.) from *L. peregra* does not develop in the domestic duck or, if it does, it produces adults so small that they may be easily passed over at a post-mortem examination.

RURAL ENGINEERING.

Studies made by the agricultural engineering department [at the Montana Station], H. E. MURDOCK (*Montana Sta. Rpt. 1921, pp. 20–25, figs. 5*).—Duty of water studies showed that on the Valier project the amount of water applied by farmers during two years varied from 6 to 43 in. in depth, the small amount being applied to small grain with a large head of water in one irrigation and the large amount to alfalfa in three irrigations. The losses from the field varied from 0 to 45 per cent of the amount applied, depending upon the head, the method of irrigation, the attention given to the water, and the condition of the surface of the field. The average waste was from 22 to 23 per cent. The field receiving the smallest amount of water had the largest amount of waste, owing to the use of too large a head.

A series of tests in the Bitter Root Valley on seepage in distribution laterals disclosed very large losses, averaging about 30 per cent of the total amount entering the laterals. The opinion is expressed that a large portion of this loss can be avoided by proper design and construction of laterals.

Brief data are also included on studies of water storage, drainage of seeped lands, preservative treatment of farm timbers, cost of cutting silage, sewage disposal for the isolated home, and power from the bull.

Surface water supply of Colorado River Basin, 1918 (*U. S. Geol. Survey, Water-Supply Paper 479 (1922), pp. V+189, pls. 2*).—This report, prepared in cooperation with the States of Arizona, Colorado, Utah, and Wyoming, presents the results of measurements of flow made on streams in the Colorado River Basin during the year ended September 30, 1918.

Surface water supply of the Great Basin, 1918 (*U. S. Geol. Survey, Water-Supply Paper 480 (1922), pp. VI+271, pls. 2*).—This report, prepared in cooperation with the States of Utah, Nevada, California, Oregon, and Wyoming, presents the results of measurements of flow made on streams in the Great Salt Lake and Sevier Lake Basins and other drainage basins within the Great Basin during the year ended September 30, 1918.

The use of the air lift, E. CUNNINGHAM (*Dom. Engin., 101 (1922), No. 9, pp. 371–374, figs. 4*).—General information is given regarding air lift pumps, together with tabular data showing the economical capacity of discharge pipe in gallons per minute under different conditions of lifts and submergences.

Highway research projects in the United States, W. K. HATT (*Bul. Natl. Research Council, 4 (1922), No. 21, pp. II+103*).—This bulletin contains a census of 479 research projects in highway engineering and highway transport, current or recently completed, in which are sought those data upon which highways may be wisely selected, economically built to conform to the mechanics of the situation, and operated in the interests of the public.

Handbook of construction cost, H. P. GILLETTE (*New York and London: McGraw-Hill Book Co., Inc., 1922, pp. XVII+1734, figs. 296*).—This handbook contains 1,734 pages of data on engineering economics and the costs of engineering construction of all kinds. Special sections are included on costs of construction of concrete structures, dams, reservoirs, waterworks, irrigation and land drainage structures, highway bridges and culverts, and roads and pavements.

Electrical characteristics and testing of dry cells, G. W. VINAL and L. M. RITCHIE (*U. S. Dept. Com., Bur. Standards Circ. 79, 2. ed., (1923), pp. 62, pls. 2, figs. 19*).—This is the second edition of this report, which summarizes the available information on dry cells, including a brief description of the materials and methods of construction and the elementary theory of operation. The various sizes and kinds of dry cells on the American market are described, and

their electrical characteristics and methods of testing are discussed. Specifications for dry cells are appended.

Motor trucks on Corn Belt farms, H. R. TOLLEY and L. M. CHURCH (*U. S. Dept. Agr., Farmers' Bul. 1314 (1923), pp. II+18, figs. 8*).—This is based on the experience of more than 500 grain and live-stock farmers located in the Corn Belt, each of whom has owned and used a motor truck for more than two years. Its purpose is to assist other farmers in the same region in determining whether or not they can use trucks profitably, and also to assist men who already own trucks in determining whether or not they are using their machines as efficiently as others.

Recommended specifications for pneumatic tires, solid tires, and inner tubes (*U. S. Dept. Com., Bur. Standards Circ. 115 (1921), pp. 18*).—These specifications, covering the requirements for pneumatic tires, solid tires, and inner tubes, were recommended by the Interdepartmental Committee on Specification Standardization, and are now used throughout the Government service. The physical and chemical tests required are such that the material purchased under these specifications will be satisfactory. Thus, requirements are placed on the materials entering into the manufacture of tires and tubes and also on the finished articles.

Fuel for motor transport (*London: Dept. Sci. and Indus. Research, Fuel Research Bd., 1921, pp. IV+16*).—This publication enumerates and discusses the different sources of fuel alcohol in England. The conclusion is drawn that the prospect of adding materially to the supplies of liquid fuel for internal-combustion engines by the manufacture of alcohol from home-grown materials is remote.

The production within the British Empire of alcohol from materials containing sugar or starch is considered to be commercially possible in the near future only in some of the dominions and colonies, and then only on a sufficient scale to meet local requirements. Synthetic production on a commercial scale in England is also considered to be unlikely.

New data on burning kerosene oil in house-heating boilers, J. HARRINGTON (*Heating and Ventilating Mag., 19 (1922), No. 9, pp. 41–44, figs. 5*).—The results of three series of experiments comparing coal burning, oil burning in a boiler designed for coal, and oil burning in an oil boiler are reported graphically and discussed. Both hard and soft coal were used.

The results were markedly in favor of oil burning in house heaters, both in boilers designed for coal burning and in those for oil burning. The best results were obtained in the oil-burning furnace, both as regards uniformity and flexibility of heating. With anthracite coal the house temperature varied from 60 to 80° F. during the experimental period and was rarely ever at the desired 68° for more than a few hours at a time. The anthracite was not nearly so responsive a fuel as the soft coal. Considerably greater difficulty was encountered with both coals in bringing the house temperature from below up to normal than with oil.

It was further found that to get proper results with anthracite coal it must be burned under exactly the right conditions, and that low rates of combustion are very inefficient. The cost of oil burning compared quite favorably with that of the best of coal burning.

Tests of humidity conditions in a residence heated by a warm-air furnace using recirculated air, A. P. KRATZ (*Jour. Amer. Soc. Heating and Ventilating Engin., 28 (1922), No. 1, pp. 11–20, figs. 6*).—In a contribution from the University of Illinois, studies are reported the original object of which was to determine the evaporation rate of three different types of water pans for va-

rious rates of combustion in a warm-air residence furnace and also the effect of the location of the pan upon the evaporation rate.

It was found that more water is evaporated per square inch of surface from a pan supported on the dome of a furnace than from pans placed around but not touching the fire pot. The best location for a crescent-shaped pan surrounding the fire pot was found to be midway between the casing and the fire pot. The crescent-shaped pan was not very effective in increasing the relative humidity. In tests with soft-coal fuel the actual change was only from 23.6 to 28.4 per cent. At no time was frost or condensation observed on the outside glass with either of the above humidities.

Increasing the relative humidity made it possible to maintain the same difference in temperature between the air at the breathing line and the outside air with the use of lower register temperature.

The evaporation per square inch per 24 hours from the surface of the water in a crescent-shaped water pan, surrounding but not touching the fire pot, varied with the intensity of the radiation from the fuel bed. This in turn was found to be a function of the temperature and density of the fuel bed. The heat radiated from a hard-coal fuel bed was much greater than that radiated from a soft-coal fuel bed.

The coal consumption for a furnace in service was not materially decreased when the humidity was increased and the temperatures at the breathing line maintained constant. The air conditions were decidedly more satisfactory to the occupants of the test house after the installation of the crescent-shaped pan than before, notwithstanding the fact that the actual increase in relative humidity was small.

Fuel-saving possibilities in househeating, L. M. Arkley and J. Govan (*Canada Council Sci. and Indus. Research Rpt. No. 10 (1922), pp. 55, figs. 6*).—This report presents data on the proper construction of houses and the operation of heating plants to effect economy in fuel consumption. It is divided into two parts.

Part 1, by L. M. Arkley, deals with fuel saving in furnace installation and operation, describing methods of househeating and drawing special attention to proper chimney construction. Other factors considered are furnace operation, coal, air supply, pipe covering, and humidity. A set of rules for furnace operation is presented.

Part 2, by J. Govan, deals with the advantages of better insulation, planning for sunlight, and improved air conditions. A bibliography is appended.

Report on heat insulators by the engineering committee of the Food Investigation Board ([*Gt. Brit.*] *Dept. Sci. and Indus. Research, Food Invest. Bd., Spec. Rpt. 5 (1921), pp. 61, figs. 16*).—Studies of the thermal conductivity of the insulating materials commonly used in cold-storage work are reported.

It was found that cork, slagwool, charcoal, and wood fibers, when of good quality and dry, have practically the same thermal conductivities, namely, 0.00011 gram calorie per second per centimeter per 1° C. (0.32 B. t. u. per square foot per hour for 1 in. thickness and for 1° F. difference in temperature). "Judging from the fact that such entirely different materials are about equally good as insulators, it would appear that their resistance to conduction is not very far from the limiting value that is practically obtainable by subdividing the air space. In this connection it is of interest to note that still air has a thermal conductivity of only 0.00005 c. g. s. units [0.14 B. t. u. per square foot per hour for 1 in. and for 1° F. difference] or barely half that of the best of these materials, so there is still a margin for improvement by finding a more suitable material in cellular form."

Different brands of cork varied slightly in efficiency as insulators, but it is concluded that with samples of good quality such differences are not very considerable.

"It is clear that the thermal conductivity of materials in general, such as cork, is not an invariable physical constant like the thermal conductivity of pure metals. It follows that it is advisable to test samples of various consignments just as it is desirable to determine the calorific value of a fuel or any other commercial commodity. Materials that are liable to deteriorate in use decrease in efficiency as insulators in consequence of such change, and the tests indicate that the decrease may be quite considerable. Coarse granular materials permit of the circulation of convection currents in the material which complicate the phenomenon of the heat transmission."

Supplementary studies of so-called cellular expanded rubber, consisting of rubber expanded by gas into a highly cellular form, showed that the conductivity of this material was lower than that of cork or of any other substance studied, being only one and one-half times that of still air. The weight of the cellular rubber was only about half the weight of an equal volume of slab cork. The conductivity of spongy rubber was found to be greater than that of cork. Descriptions of experimental methods used are appended.

The transmission of heat by radiation and convection, E. Griffiths and A. H. Davis ([*Gt. Brit.*] *Dept. Sci. and Indus. Research, Food Invest. Bd. Spec. Rpt. 9 (1922), pp. IV+44, figs. 21*).—This is a highly technical report of experiments conducted to obtain data which would be of assistance in investigations on problems of insulation connected with cold-storage construction.

The first part deals with the transmission of heat by radiation, with particular reference to the effects of temperature, partitions, and the use of different colored paints on radiating surfaces. The actual temperature of surfaces was found to have a marked influence on the quantity of heat transmitted for a given temperature difference. The effect of a partition was to reduce to one-half the heat transferred by radiation from a hot surface to a cold surface. Two partitions diminished the radiation to about one-third. Various colored paints were found to be indistinguishable as regards heat radiation.

The convection studies were limited to natural convection within a closed room. It was found that heat loss by convection increases more quickly than the first power of the temperature excess, and that a power of 5/4 seems generally very satisfactory. Heat loss by convection was naturally least in the horizontal position facing downward, but the rate of loss in a vertical position of a surface was practically a mean of the rates of the two positions of the horizontal surface facing upward and downward. A floor was found to reduce the cooling of a vertical surface by about 4 per cent. On the other hand, the introduction of horizontal baffles above the floor increased the cooling by insuring that the upper portions of the surface are swept by cold air rather than by air which has been previously warmed by contact with the lower portions of the surface.

In studies of the distribution of temperature and velocity in the convection stream it was found that the disturbance in the atmosphere due to the convection currents set up is confined within a distance of 2 cm. from the surface of the hot plate.

Studies of the insulating properties of an air space showed that within the limits of experimental error, the heat transfer by convection from a unit area of surface across a closed vertical space is independent of the height and width

of the space. From 2 in. down to 0.5 in. the width of air space had no influence on the magnitude of the transfer by convection.

An inquiry into the effect of size and geometrical form on loss of heat by convection showed that for pipes less than 8 in. in diameter the heat loss per unit area decreased as the diameter increased. For pipes of from 8 to 12 in. in diameter the heat loss per unit area was, roughly, independent of the size and curvature, and appeared to be the same for cylinders and plates.

Experiments to determine the influence of height of wall on convection loss from a unit of area showed that the relation between convective heat loss and temperature excess depends upon the height of the wall, and conversely that the effect of height depends upon the temperature excess. This is considered to point to the conclusion that the equation of heat loss can not be expressed in such a form that the height and the temperature excess are separate factors, but that these variables must be suitably grouped together. The equation connecting convection loss with both the temperature and the dimensions of a hot body is deduced by the principle of similitude, and data for vertical planes and horizontal cylinders are summarized.

A description of the instrument used in investigating convection currents is appended.

Heat conductivity of brick wall work, C. Nuszbaum (*Gsndhts. Ingen., 39 (1922), No. 45, pp. 498–500*).—Data are presented and discussed on the heat conductivity of brick wall and roof construction and on the computation thereof. The opinion is expressed that the heat conductivity of such construction can not be adequately expressed by a single factor.

RURAL ECONOMICS AND SOCIOLOGY.

Farm management studies on dry land areas in northern Montana, E. L. Currier (*Montana Sta. Rpt. 1921, pp. 57, 58*).—A survey was started in 1920–21, which is to be continued from year to year, and farm analysis records were obtained on 117 dry land farms in Chouteau, Hill, Blaine, and Phillips Counties.

With the exception of some in the Chouteau County area, farms almost without exception were operated at a loss. In the Highwood bench area of Chouteau County straight wheat growing on the summer fallow plan gave the largest return in 1921. In the other areas of the county there was a smaller loss on farms with some live stock than on straight grain farms. During this particular year the farmer who invested the least in labor, materials, and other expenses incurred the smallest loss. On the small farms more intensive methods were possible without hiring extra help, while on the larger ones where summer fallowing was practiced it was necessary to hire extra help, and the additional yields obtained in 1921 were not sufficient to justify the extra expense. It is concluded that before live stock can become an important factor in the solution of the dry-farm problem in this district there must be a reduction of land values and the inclusion of much larger areas in the farms.

Farm management studies in the Gallatin Valley, E. L. Currier (*Montana Sta. Rpt. 1921, pp. 55–57*).—A comparison is made of farm analysis data from farms in Gallatin Valley in Montana for 1913 (E. S. R., 37, p. 290), 1918, 1919, and 1920.

Farmers in this region lost money in 1919, as indicated by an average minus labor income for 80 farms of $731; that on 77 farms in 1920 was minus $2,113. In the last year the receipts on these farms were somewhat less than in 1913, but it is to be noted that the expenses had practically doubled. This, together with the fact that capitalization on these farms had increased about 60 per

cent, making necessary the setting aside of a considerably larger amount to cover interest charges, resulted in a very bad financial condition. There is an indication that since land values have increased and low prices persist for grain and hay, due to increased freight rates and other causes, a more intensive type of farming, with greater interest in dairying and the raising of high grade live stock, is imperative.

Farming plans for the Piedmont section of Georgia, E. C. Westbrook and De F. Hungerford (*Ga. Agr. Col. Bul. 270 (1922), pp. 40, figs. 24*).—Recommendations are drawn up here for the one family farm and for the plantation, in both instances taking into consideration the most economical distribution of man and horse labor between the crops of a diversified system and in the raising of live stock.

Systems of farming for south Georgia, De F. Hungerford and E. C. Westbrook (*Ga. Agr. Col. Bul. 273 (1923), pp. 32, figs. 17*).—Systems of farming designed to make the most economical use of labor and equipment are recommended here.

The Nebraska farm family—some land tenure phases, J. O. Rankin (*Nebraska Sta. Bul. 185 (1923), pp. 31, figs. 9*).—This study is based mainly upon the results of a cooperative survey conducted in 1920–21 of about 1,145 farm homes in 10 selected areas in eastern and southern sections of Nebraska (E. S. R., 47, p. 798). Some data are included from a survey made in cooperation with the Interchurch World Movement in 1920.

Of the tenants studied, 44.6 per cent were related to their landlords. Most related tenants have practically as much interest in the community as do owners. Such relationship affects rental terms, and is affected in many ways by tenure variation tending to reduce the number of farms on which tenure problems may become serious.

Other phases of the tenure situation analyzed from this survey are the marital condition of operators, the number and marital condition of hired men, the ages of operators and their wives, the birthplace of parents and children, education, and serious illness.

Cooperative consolidation of holdings, O. Rothfeld (*Bengal, Bihar, and Orissa Coop. Jour., 8 (1923), No. 3, pp. 230–239*).—Two laws dealing with the consolidation of small agricultural holdings in France are outlined here, as is also legislation along similar lines which has been proposed in Holland.

The labor required for crop production in Ohio, R. F. Taber and C. R. Arnold (*Ohio Agr. Col. Ext. Bul., 18 (1922–23), No. 5, pp. 16, figs. 11*).—The material summarized here was collected during the summer of 1921 from personal interviews with 324 farmers in Ohio. Data were secured as to the kinds and sizes of tools used in the field work and the normal accomplishment in a 10-hour day. Information was also gathered relating to the kinds of crops grown, the acreages, and the size of fields, as well as methods and practices followed in crop production. Farms were visited in Perry County, in southeastern Ohio; in Mercer County, in the western part of the State; Seneca County, in northwestern Ohio; and Trumbull County, in the northeast.

Tables have been prepared which show the average accomplishment in the different counties in doing field work with tools of different types and sizes, also the average number of times various operations are performed in corn and wheat production in the four counties, and the man-labor requirement in the production of corn in the same sections.

Labor on the farm, A. G. Ruston and J. S. Simpson (*Jour. Min. Agr. [London], 29 (1922), Nos. 8, pp. 697–705, figs. 3; 9, pp. 801–808*).—Accounts from several farms in Yorkshire, England, covering a period of years are

reviewed to determine the bill for manual labor and its variations. It is pointed out that in one instance the reduction in hours on four farms studied necessitated the employment of 7 men in 1921 to accomplish the work performed by 6 in 1912.

It is concluded that from the outbreak of the war up to the year 1918 labor was not getting its fair share of the increased prosperity of the farms, and it was not until January, 1920, that the increase in farm wages had actually risen in proportion to the increase of the cost of living. At the time of the abolition of the Agricultural Wages Board the percentage increase in farm wages was approximately 20 points above that in the cost of living, and in April, 1922, it was at least 45 points above. At present rates the surplus obtained by labor from January, 1920, until April, 1923, would not counterbalance the deficit from the outbreak of the war up to January, 1920. The percentage increase in farm wages which were being paid in April, 1922, was apparently higher than in many other industries, and during the last two years farm labor has been getting more than the industry could reasonably expect to grant. For the year ended March 31, 1922, the average labor bill amounted to approximately £3 15s. per acre, with considerable variations on different farms.

[Advertising and the farm market] (In *The Advertising Yearbook for 1922, edited* by N. T. Praigg. *Garden City, N. Y.: Doubleday, Page & Co., 1923, pp. 1–5, 234–247*).—The following articles are brought together here: Agriculture—An Advertising Opportunity, by W. M. Jardine; Making a Home on the Farm To-day, by Mrs. F. D. Brownell; How Business Prosperity Hinges on Farm Financing, by E. Meyer, jr.; and The Farm Market—Ever Important, by E. T. Meredith.

Uncle Sam, marketman, C. B. Sherman (*Survey, 50 (1923), No. 2, pp. 96, 97*).—This presents briefly the purpose and the method of operation of the Center Market in Washington, D. C., by the U. S. Department of Agriculture.

The market was taken over in order to make it a vital part of the food-distributing system of the city, to provide a laboratory for retail market studies, and to make it a paying business proposition. It already shows the advantages of improved equipment and what can be done in the way of rejuvenating an old market, particularly in the matter of sanitation.

Plans for cooperative marketing, O. B. Jesness (*Ky. Agr. Col. Ext. Circ. 134 (1922), pp. 36*).—Articles of incorporation, by-laws, and contracts have been drawn up, with special reference to the cooperative marketing act of Kentucky.

Danish agriculture with special reference to cooperation, J. Warming (*Quart. Jour. Econ., 37 (1923), No. 3, pp. 491–509*).—A shift in the relative prices of grain and animal products during the 250 years previous to 1913 led Danish farmers to produce butter and pork, American competition in grain production accelerating this movement about 1880. The principal markets for Danish products have been England and Germany. The intensive cultivation required is said to involve low net profits in proportion to gross receipts. Very careful bookkeeping is required by such a system. The author holds that the keeping of good accounts with proper divisions for the different branches on the part of about 10 per cent of the farmers, from representative sections of the country and from the different sized farms, would be sufficient to yield instructive statistics. The Danish cooperative system, including dairies, market associations, savings banks, and credit associations, based principally on the export articles, butter and bacon, is described. It is considered that so long as the roundabout industry of importing feeding stuffs from North and South America and exporting finished products to England is profitable, the Danish small farmers will develop it to the highest possible degree.

The revival of the cooperative movement in Russia, A. S. ORLOFF (*Russ. Econ., 2 (1922), No. 6, pp. 1935–1970*).—The decree of the Soviet Government of April 19, 1921, restored the sanction for agricultural cooperatives which had been withdrawn in 1920. A few pages of this report set forth the progress of agricultural societies organized since the restoration.

Report on the working of cooperative societies in Bihar and Orissa for the year 1921–22, M. AHMED (*Bihar and Orissa Coop. Socs. Rpt., 1921–22, pp. [5]+23+XXV+3, pl. 1*).—The series of annual reports previously noted (E. S. R., 47, p. 298) is continued here.

Note on rural housing (*Bengal, Bihar, and Orissa Coop. Jour., 8 (1923), No. 3, pp. 245–247*).—Suggestions are made as to the operations of rural cooperative housing societies for India.

Man in agriculture, G. STIEGER (*Der Mensch in der Landwirtschaft. Berlin: Paul Parey, 1922, pp. XV+437, figs. 38*).—This theoretical discussion of human labor as applied in agriculture takes up first the subject of the physiology of nutrition and muscular energy and the psychology of manual labor. Other phases of the subject included in this treatment are labor as an item of expenditure and provisions for it in systems of agricultural bookkeeping; the land worker in statistics of the total German population; the kinds of labor required in agriculture; wages and wage agreements; the labor supply; woman and child labor in agriculture; nonagricultural winter work and rural industries; supervision; equipment, tools, clothing, and housing; small peasant and laborers' settlements; standards of living; rural welfare; labor education; labor in business theory; and peasant societies.

The beginnings of agriculture in America, L. CARRIER (*New York and London: McGraw-Hill Book Co., Inc., 1923, pp. XVII+323, figs. 31*).—The chapters of this book, designed as a reference work, deal with the value of agricultural history, Old World agriculture, the American Indians, native vegetation in America, American and South and Central American Indian crops, miscellaneous Indian products and agricultural practices, the exploration period, English colonial settlements, the several colonies, French settlements and influence, colonial expansion, the introduction of European crops and of domestic animals, farm implements and the use of fertilizers, slavery, the effect of colonial commerce on agriculture, and relations with the mother country. Many excerpts from early narratives and records and from correspondence dated in the colonial period are introduced. A bibliography of 135 titles is included.

The place of agriculture in the life of a nation, V. A. MALCOLMSON (*Westminster, Eng.: P. S. King & Son, Ltd., 1922, pp. 28*).—This pamphlet contains three papers, namely, seven lean kine, the influence of foreign exchanges on employment, and agriculture on an empire basis. The first two appeared in trade journals in January, 1922.

The Golden Fleece, an introduction to the industrial history of England, G. W. MORRIS and L. S. WOOD (*Oxford, Eng.: Clarendon Press, 1922, pp. 224, figs. 83*).—This is a brief survey of the growth of the sheep raising industry in England and the wool trade, emphasizing the effect of these activities upon British foreign policy and colonial expansion.

The making of rural Europe, H. D. IRVINE [*London: George Allen & Unwin, Ltd., 1923, pp. 224*).—An historical and critical account of the rise of the peasant class is represented here in chapters dealing with the medieval system, the tenant in villeinage, where collectivism persisted, the latifundia, the servile peasant, the tenant farmer, the small owner, what happened in England, the wage-earning laborer, rural syndicalism, agricultural cooperation, and the agrarian revolutions of to-day.

Rural community organization: Present status and tendencies, W. Burr (*World Agr., 3 (1923), No. 1, pp. 215–217*).—Replies to 100 letters sent to men in economic and social fields, directors of extension, and professors of rural sociology and kindred subjects, questioning them as to the status and tendencies of the rural community movement, are the basis of this report. It is concluded that the general community movement is at the present time an active one, though religious organization on a parish plan with national federation is needed. The organization into the school system of outside educational and recreational agencies is advocated, as are also conscious economic organization, a unified plan of community life, and organized social extension work.

Some rural social agencies in Ohio: Their nature and extent, C. E. Lively (*Ohio Agr. Col. Ext. Bul., 18 (1922–23), No. 4, pp. 48, figs. 30*).—Information regarding intellectual, religious, health, social, and recreational agencies of State and national scope, as well as the local ones, was collected by specialized agencies and organizations and from questionnaires sent to local people. Dot maps of Ohio are given showing the location of the organizations reported.

There were 1,272 trade area rural communities, of which 69 per cent supported a grange, 55 per cent lodges, 42 pool halls, 33 an annual Chautauqua or lyceum, 26 open societies, 23 a moving picture theater, 22 a band, 19 an orchestra, 19 a public dance hall, 16 a local newspaper, 13 a girl scouts or camp fire girls' troop, 12 a boy scout troup, 10 an annual home-coming, 9 a parent-teacher association, 9 an annual picnic or festival, 7 a local library, 7 a farmers' or community club, 6 an annual corn, fruit, or dairy show, 6 a chorus or singing society, and 5 per cent a community fair. Of this number of communities 12.8 per cent reported none of the 20 agencies; 17.1, 1; and 14, 11.4, 10.6, 7.5, 6.4, 5.5, 5.1, 3.7, 2.9, 1.1, 0.04, 0.05, and 0.01 per cent reported from 2 to 14, respectively.

Oxford and the rural problem, H. Plunkett (*London and New York: Humphrey Milford, Oxford Univ. Press, 1921, pp. 18*).—This paper gives a sketch of the rural problem, with particular reference to Irish conditions and the Irish scheme of rural regeneration as embodied in the cooperative movement. The author points out what he holds to be the concern of the universities in the rural problem, and suggests the development of study and redirection of thought at Oxford University which would provide rural leaders.

The amelioration of living and working conditions in the country, M. Queuille (*Vie Agr. et Rurale, 22 (1923), No. 3, pp. 41–47, figs. 2*).—Propositions with reference to agricultural wages, living conditions, housing, and measures for improving rural life in order to keep the laboring population on the land are reviewed here as promulgated by two congresses, one of the National Federation of Agricultural Labor at Lyon in 1919 and the other of the National Confederation of Agricultural Associations at Tours, France.

Interim report of the Drought Investigation Commission, Union of South Africa, H. S. du Toit et al. (*Cape Town: Govt., 1922, pp. [2]+29, pl. 1*).—Evidence submitted before a commission appointed in 1920 to investigate and report upon certain matters connected with periodic droughts in the Union of South Africa is reported upon here. It is indicated that the practice of fencing pastures occasioned mainly by the presence of the jackal, the inadequacy of drinking water facilities, the destruction of vegetation, and the resulting soil erosion, which in turn leads to a serious diminishing efficiency of the rainfall, are the main causes of drought loss. While the mean annual rainfall remains constant, its economic value has been reduced. The recommendations of the commission cover essentially the organization of the farming community, the extermination of the jackal, the provision of cheap

fencing material, the development of water supply for stock, the adoption by the State of responsibility for the control of soil erosion, and investigation by the agricultural department of grazing and fodder problems.

Report of the secretary of agriculture and natural resources, R. CORPUS (In *Report of the Governor General of the Philippine Islands. U. S. House Represent., 67. Cong., 2. Sess., Doc. 398 (1922), pp. 163–233*).—These pages present the work of the Philippine department for the year 1921 in the administration of the bureaus of agriculture, forestry, lands, and science and the weather bureau, and in connection with rice colonization and plantation on public lands, the establishment and maintenace of stock herds and farms, the administration of the fund to be loaned to rural credit associations, and the control of natural resources. Four Government agricultural colonies are reported upon. The bureau of lands reports the progress of homesteading, leasing, and reclaiming lands and of the cadastral survey.

Statistics of the production of cereals and legumes in 1922 (*Estadística de la Producción de Cereales y Leguminosas. Madrid: Junta Consult. Agron., 1922, pp. 40*).—These tabulated annual statistics for Spain continue the series of reports previously noted (E. S. R., 46, p. 696).

Statistics of agricultural and pastoral production, C. W. COUSINS (*Union So. Africa, Off. Census and Statis., Agr. Census No. 4 (1921), pp. XX+86*).—Census returns are reported continuing information previously noted (E. S. R., 46, p. 696).

Notebook of agricultural facts and figures for farmers and farm students, P. MCCONNELL (*London: Crosby Lockwood & Son, 1922, 10. ed., rev. and enl., pp. 538+XI, figs. 15*).—This is a compilation of figures and other reference data, tabulated in so far as possible, dealing with mensuration and leveling, weights and measures, machinery and buildings, labor, soils, manures, crops, feeding, dairying, live stock, forestry, horticulture, and miscellaneous items.

AGRICULTURAL EDUCATION.

Rural school health survey of the Missouri Tuberculosis Association, E. MOORE (*St. Louis: Missouri Tuberculosis Assoc., 1922, pp. 46*).—This survey was carried on in six counties in different parts of the State during portions of three years—1919, 1920, and 1921—in 48 schools in the open country and 11 village schools, 9 of which included a high-school department. With one exception, where the population was 812, all of these villages had fewer than 500 inhabitants. In the six counties 2,298 pupils were examined, all of which were white with the exception of 10 in one town. The physical examinations, which were made in cooperation with local physicians and in some cases with local dentists, consisted of weighing and measuring the pupils and tests of vision and hearing by the survey workers, of examination of the teeth by dentists or by the survey workers, and of physician's examinations of the nose and throat, heart, and lungs, with notation of other defects which might be observed in a schoolroom examination. The survey workers then visited the home of each grade-school pupil, so far as possible, and obtained home records for 1,499 pupils.

Of the 1,897 children weighed, 20 per cent were 10 per cent or more below standard weight. Twenty-four per cent of town children were seriously under weight as compared with 18 per cent of rural children. In general, no correlation could be shown between the home environment and the physical condition of the child. Fairly satisfactory conditions with reference to personal hygiene were found. With few exceptions the defects of diet noted in this

report were not due to poverty, but rather to ignorance of what constitutes a wholesome, properly balanced diet for adults or children.

A summary of recommendations is given and tabulations of details of the findings.

Work of the joint committee on rural schools, G. A. Works (*N. Y. State Hort. Soc. Proc., 67 (1922), pp. 213–223*).—Some of the principles upheld by this committee in its investigation of the teaching staff, building and equipment, and courses of study of the rural schools in New York State are briefly outlined, and findings and recommendations are summarized, especially with respect to State school administration and supervision.

Agricultural education, S. Milligan (*India [Dept. Agr.] Rev. Operations, 1919–20, pp. 66–72, pl. 1; 1920–21, pp. 47–52, pl. 1; 1921–22, pp. 76–83, pl. 1*).—Annual progress reports of agricultural colleges, middle schools, and others in India are submitted here.

Handbook of information for State officials cooperating in the administration of the Vocational Rehabilitation Act (*Fed. Bd. Vocat. Ed. Bul. 77 (1922), pp. V+48*).—This presents briefly the policies thus far adopted by the Federal Board of Vocational Education for the administration of the Vocational Rehabilitation Act. It gives also such information as is required by State officials in their dealings with the Federal Board in the administration of the act.

Vocational education in agriculture, C. H. Lane (*South. Workman, 52 (1923), No. 3, pp. 124–131, figs. 3*).—This reviews the general agricultural provisions of the Smith-Hughes Act and sets forth the nature of the instruction in agriculture and teacher training offered especially to colored students.

Vocational education in home economics, A. C. Baylor (*South. Workman, 52 (1923), No. 3, pp. 132–137, figs. 4*).—Fourteen Southern States are said to have accomplished far-reaching results in maintaining a vocational program for the colored population. The program for home economics teaching is now arranged to include more courses in food and clothing, the care of the home, the expenditure of the income, home nursing, and the care of children than formerly. Courses of this nature are briefly described, and certain community enterprises carried out by the teachers and students in vocational departments, often in cooperation with city and county nurses, the Red Cross, the Associated Charities, and the home demonstration agent, are noted. The special efforts made to raise the standards of instruction in teacher training are also set forth.

List of references on the project method in education (*U. S. Bur. Ed. Libr. Leaflet 17 (1923), pp. 9*).—References bearing upon the project method in agriculture, home economics, and related sciences are presented here, together with references on other topics.

Teaching field crops and horticulture, S. L. Chesnutt (*Montgomery, Ala.: Dept. Ed., 1922, pp. 111, figs. 24*).—Methods and materials for classroom lessons and exercises are presented as supplementary to teachers' outlines of work. Attention is directed to the need of teaching the fundamental principles underlying crop production and of considering the research and laboratory periods as a unit. A job analysis and teaching exercises are given for the selection of seed corn, terracing land, home mixing of commercial fertilizers, propagation of plants, and pruning, as well as type exercises in both field crops and horticulture.

Poultry as a required course in the agricultural curriculum, L. F. Payne (*Poultry Sci., 2 (1923), No. 3, pp. 78–84*).—Arguments are presented in favor of the adoption of poultry husbandry as a requirement in the college agricultural course.

A course of study in farm shop work for rural and village high schools, R. FIFE (*Columbus, Ohio: [State Dept. Ed.], 1921, pp. 26, figs. 4*).—It is intended to present to superintendents, supervisors, and manual arts instructors the demands of modern rural education for farm shop work. The project method is favored. A course of study is outlined to include agricultural drawing, farm woodworking, tool sharpening, painting, harness repairing, rope and metal work, and belt lacing. Farm shop equipment is listed, and reference books are suggested.

Outlines of course of instruction in agricultuhral nature study for the rural schools of California, O. J. KERN (*California Sta. [Pamphlet], 1923, pp. 106, figs. 60*).—This publication presents outlines for grades 1 to 8, inclusive, with suggestive material for the use of teachers in the rural elementary school, which is grouped under the four general topics of human needs, interests, and activities; plant life throughout the year; animal life throughout the year; and natural phenomena and the inorganic world and soil studies. Lessons in physiology and hygiene for the first six grades are included in nature study. Lists of materials are included which have been prepared by members of the staff of the College of Agriculture of the University of California. These cover, respectively, farm crops; common injurious and beneficial insects; troublesome weeds in California for study in the rural schools; flowers, shrubs, vines, and bulbs; tropical and semitropical fruits; some common California trees; classes of soil; common varieties of fruits; common California birds; and common California mammals. A list of reference books is presented. Lesson plans in agricultural nature study by K. L. Reid are drawn up for all eight grades.

The pig book for boys and girls, W. W. SMITH (*Philadelphia and London: J. B. Lippincott Co., 1923, pp. 171, figs. 42*).—Practical information is given with regard to the care, feeding, and showing of pigs. An introduction and chapter on special instructions for pig club leaders, together with a suggested outline for pig club work in the appendix, are contributed by F. M. Shanklin.

Changing conditions on the farm, A. C. TRUE (*Jour. Amer. Bankers Assoc., 15 (1922), No. 3, pp. 139–141, figs. 2*).—The achievements of extension work carried on by means of farm and home demonstrations and boys' and girls' club work are reviewed in these pages.

MISCELLANEOUS.

Federal legislation, regulations, and rulings affecting land-grant colleges and experiment stations (*U. S. Dept. Agr., Dept. Circ. 251 (1923), pp. 50*).—A revision to March 28, 1923, of the publication previously noted (E. S. R., 42, p. 496).

Twenty-eighth Annual Report of Montana Station, 1921, F. B. LINFIELD ET AL. (*Montana Sta. Rpt. 1921, pp. 94, figs. 41*).—This contains the organization list, a financial statement for the fiscal year ended June 30, 1921, and a report of the director and heads of departments on the work of the station. The experimental work reported is for the most part abstracted elsewhere in this issue.

NOTES.

Arizona University and Station.—The resignations on June 30 are noted of Dr. R. H. Williams as professor of animal husbandry and animal husbandman and G. E. Thompson as professor of agronomy and agonomist. E. B. Stanley, assistant animal husbandman, returned August 1 from a year's leave of absence at the Iowa College. Ian A. Briggs has been appointed instructor in agronomy, effective August 1.

Iowa College and Station.—The State Board of Education has recently approved a building program which calls for the immediate erection at the college of a home economics building to cost not to exceed $500,000, a dairy cattle judging pavilion at the dairy farm, an addition to the college hospital, and the completion of a large dormitory, part of which was built last year. Many other smaller improvements are also in the program.

The vacancy in the headship of the work in horticulture caused by the death of S. A. Beach has been filled by the appointment of B. S. Pickett, professor of pomology at the University of Illinois. Dr. C. L. Holmes, professor of farm management, has succeeded Dr. E. G. Nourse as head of the department of agricultural economics and farm management. Paul L. Miller of the U. S. Department of Agriculture has also been given an appointment in this department for teaching and research.

Maryland Station.—The twenty-fifth anniversary of Dr. H. J. Patterson's services as director was observed by the station staff and former members June 30.

Michigan College and Station.—O. T. Goodwin has resigned as associate professor of dairy manufacturing, effective May 10. George Starr has been transferred from the extension division of farm crops to become research associate in horticulture and extension specialist in vegetable gardening.

Minnesota University and Station.—The flax development committee of an association of eastern paint and oil dealers has given $1,000 to the university to be used in securing more knowledge about the growth of wheat and flax in mixtures. A local milling company has made a gift of $2,000 for the construction of a cereal breeding greenhouse, which is now completed, and a fellowship of $1,000 has been established by a Cincinnati concern for the purpose of promoting research in biochemistry as it relates to the cracker industry.

J. H. Allison, professor of forestry, has been granted a year's sabbatical leave for a study of forest management in Sweden under a fellowship from the American Scandinavian Foundation. The resignations are noted of Dixon L. Bailey as assistant in plant pathology, Henry D. Barker as instructor in plant pathology, H. M. Harshaw as assistant in biochemistry, Arnold H. Johnson as special analyst in biochemistry, William S. Kelley as assistant in drainage, and E. B. Lambert as assistant in plant pathology. Arthur W. Henry has been appointed assistant plant pathologist.

Missouri University and Station.—Two automatic recording balances, sensitive to 0.05 gm., have just been installed by the soils department. They are mounted in a constant temperature case so constructed that the vapor pressure can be regulated. The instruments are to be used for studies of the rate

of water loss from different soils under varied conditions and also for determining the relative amounts of particles of various sizes in soils by means of their rate of settling from suspensions.

The dairy department is installing a refrigeration plant capable of manufacturing 100 gal. of ice cream and 1,000 lbs. of ice, and cooling the refrigeration rooms.

Dr. Louise Stanley, professor of home economics and chairman of the department, has been appointed chief of the new Bureau of Home Economics, U. S. Department of Agriculture, beginning September 1.

New Jersey College and Stations.—Progress is being made in the development of the buildings and grounds at the college. Construction is proceeding on the dairy and animal husbandry building. Several structures are being removed from the old campus, including the farm house, the stock judging pavilion, and the machinery sheds. New roads are being laid out, and contracts are about to be let for a new dairy barn and new service buildings.

The annual field meeting of the College of Agriculture and the stations was held June 16. Instead of the exercises of two or three days followed in previous years, a one-day program of a general nature was offered. Addresses were made by Governor George S. Silzer; H. J. Baker, director of extension; and Dr. R. W. Thatcher, director of the New York State Station. Tours of the grounds, field demonstrations, and educational exhibits constituted other important features. A special program for women was held under the direction of the State leader of home demonstration.

Recent resignations include Miss Ingrid Nelson as associate editor, F. J. Rimoldi as assistant professor of pomology, and R. P. Armstrong as assistant professor of horticulture. E. J. Perry has been appointed extension specialist in dairy husbandry, Dr. Fred R. Beaudette poultry pathologist, J. H. Clark instructor in pomology, Howard B. Sprague assistant in agronomy, and Roger W. DeBaun assistant editor.

New Mexico College and Station.—J. H. Bardsley, professor of poultry husbandry and poultryman, resigned August 1 and was succeeded by A. L. Walker. W. R. Naumann, assistant professor of biology and assistant biologist, and E. L. Barrows, assistant in irrigation in the station, resigned July 1 and were succeeded, respectively, by R. F. Crawford and Albert S. Curry. M. G. Snell, assistant professor of animal husbandry and assistant animal husbandman, has been appointed acting animal husbandman and P. E. Neale assistant animal husbandman. J. L. Lantow has been granted a year's leave of absence for graduate work at the University of Illinois.

New York State Station.—The station budget for the year 1923-24 carries a total of $250,035, an increase over that for the past year of $31,585. Of this sum, $16,800 is specifically appropriated for special research in horticulture in the Hudson River Valley. No permanent substation is to be established, only temporary field laboratories wherever the problems demand close attention. The work will be under the direction of the station, and three new positions on its staff have been established to cover the new lines of work. These positions include associates in research in horticulture, plant pathology, and entomology, beginning July 1, and have been filled by the appointment of Harold B. Tukey, E. V. Shear, and Dr. Frank H. Lathrop.

Provision was also made for two additional assistants in research in dairying, and these have been filled by the appointment of Julius C. Marquardt and J. C. Henning, both of whom will be engaged primarily on problems relating to dairy manufacture. Other recent appointments include Fred P. Nabenhauer as assistant in research (biochemistry) and Olaf Einset as assistant in research (horticulture).

The legislature has authorized the publication of The Small Fruits of New York, the next in the series of fruit books published by the station. Work is already under way on this book.

Ohio State University and Station.—On the ground that the bill was unconstitutional because it did not specify the buildings to be erected, the entire university building appropriation of $1,728,000 was vetoed by Governor Donahey. The legislature, however, overrode the governor's veto, reinstating the item in the State budget.

The station has been granted State appropriations for the biennium beginning July 1 aggregating $958,950. This includes $432,900 for personal services, $246,875 for total maintenance, $118,675 for additions and betterments, $56,100 for forestry maintenance, and $104,400 for forestry additions and betterments. As compared with the previous biennium, these appropriations show an increase of 65.2 per cent. In addition to the above, the station has a rotary fund of "all monies received from the sale of farm produce, dairy produce, live stock, etc." Heretofore only the proceeds from live stock sales and products have been available.

Recent appointments to the station staff include Dr. B. H. Edgington as veterinary pathologist, Dr. Roland M. Bethke as nutrition chemist in the department of animal husbandry, and the following assistants: Dr. L. L. Huber and C. R. Neiswander in entomology, John W. Bushnell and Roy Magruder in horticulture, Irvin H. Curie and L. D. Baver in soils, and L. B. Nettleton in farm management.

Pennsylvania College.—The four principal State-aided institutions in Pennsylvania have received a cut in their appropriations for the ensuing biennium by Governor Pinchot averaging 28 per cent of the sums voted by the legislature. In the case of three of these institutions, the cut is to the figure for the previous biennium, but for this college the amount provided is $213,000 less than that previously available and $822,314 below the legislature's provisions. The total available for the biennium is $2,168,000. The governor also vetoed a bill authorizing the college trustees to borrow $2,000,000 to erect and equip buildings and to liquidate existing indebtedness, holding that it is contrary to sound principle for a State institution to create debt except to pay casual deficiencies.

The resignations are noted of R. E. Irving, instructor in animal husbandry extension; L. M. Lindemuth, assistant in forestry; Miss Pearl MacDonald, professor of home economics extension; Miss M. Jane Newcomb, assistant professor of home economics extension; C. R. Mason, assistant professor of vegetable gardening; W. H. Metzger, assistant in soil technology; and G. F. Miles, assistant professor of plant pathology extension. C. D. Byrne and H. W. Cook have been appointed assistants in agricultural extension, C. R. Gearhart assistant professor of dairy husbandry extension, W. S. Krout assistant professor of plant pathology extension, Paul Seese assistant in poultry husbandry extension, R. S. Snyder assistant in pomology extension, and A. L. Strand assistant professor of entomology extension.

Rhode Island Station.—Dr. Henry B. Hall resigned as economist July 15.

South Dakota College.—Assistant Secretary Charles W. Pugsley of the U. S. Department of Agriculture has accepted the presidency of the college, beginning October 1.

Utah College and Station.—Dr. I. M. Hawley, head of the department of zoology and entomology, has been appointed acting dean of arts and science. R. J. Becraft has returned from a year's graduate work at the Iowa College and will take charge of the range management work of the station. O. W. Israelsen, professor of irrigation and drainage, has been granted a year's leave for graduate work at the University of California, and H. J. Pack, assistant

professor of zoology and entomology in the college and assistant entomologist in the station, a similar leave at Cornell University.

Virginia Truck Station.—Ray J. Davis, who has been taking advanced work in plant pathology at the University of Wisconsin, has been appointed associate plant pathologist and will have charge of the investigational work on the control of truck crop diseases.

Washington College and Station.—At the recent session of the legislature, the millage fund for the support of the college was granted in full. In addition, special biennial appropriations were made of $34,000 for the Irrigation Substation at Prosser and a new appropriation of $9,000 for investigations in cranberry culture. A slight increase for the main station was granted by the board of regents from millage funds, and a considerable increase in maintenance for several departments in the College of Agriculture.

A new hog barn 28 by 63 ft. with a feed house 20 by 22 ft. has just been completed. The foundation of a Guernsey herd for the College of Agriculture has been laid by the purchase of two bred heifers from one of the best herds in the State, and a gift of one heifer by the short course class of 1921. The college now has dairy herds of the four breeds, Holsteins, Jerseys, Ayrshires, and Guernseys.

The construction of a rooming house for farm help, a dairy barn, and two poultry laying houses to accomodate 500 birds has been authorized at the Irrigation Substation. Feeder's Day at this substation, held at the termination of tests with 876 lambs and 209 steers, including calves, yearlings, and 2-year-olds, was attended by over 600 sheepmen and stockmen.

D. J. Crowley, who last year conducted preliminary investigations in the cranberry section, has been appointed specialist in cranberry investigations, and a laboratory has been established at Seaview. Thorland R. Hall, instructor in horticulture in the Iowa College, has been appointed assistant horticulturist of the station with headquarters at the Irrigation Substation.

Chelan County for the fourth year is continuing an appropriation for the salary and expenses of a horticultural investigator under the direction of the station. Roy Larsen, formerly in charge of the work in this county, has become county agent and has been succeeded by W. A. Luce as assistant horticulturist with headquarters at Wenatchee.

A. M. Doerner, assistant professor of landscape gardening, has resigned to take up commercial work. Roy Westley, instructor in farm crops, has resigned to become extension specialist in farm crops at the University of Wyoming. E. L. Green has been appointed assistant chemist in the station vice Otto McCreary, resigned.

West Virginia University and Station.—For the ensuing biennium the legislature has appropriated $45,000 a year for salaries, $25,000 for maintenance, $15,000 for repairs and improvements, and $5,000 for live stock on the animal husbandry farm, together with $5,000 for repairs and improvements on the Reymann Memorial Farm at Wardensville. These appropriations aggregate substantially the same as those previously available.

C. H. Winkler, professor of agricultural education, has accepted a position as dean of education at the Texas College, beginning September 1. T. E. Odland, assistant professor of agronomy; F. D. Cornell, instructor in farm mechanics; Miss Eleanor Maclay, instructor in home economics; Ernest Angelo, instructor in horticulture; and Anthony Berg, assistant plant pathologist, have resigned to engage in graduate work. E. L. Anthony, professor of dairy husbandry, has accepted a fellowship from the American Scandinavian Foundation to be spent in travel in Scandinavian countries until August, 1924. J. H. Longwell, assistant professor of animal husbandry, has resigned to

take charge of a stock farm in California, O. C. Bryan as soil technologist to accept a position in agronomy in the University of Florida, and Frank Kunst as assistant chemist on account of ill health.

U. S. Department of Agriculture.—Dr. E. W. Allen, chief of the Office of Experiment Stations, has also been designated Assistant Director of Scientific Work.

Dr. Charles A. Browne, formerly chief of the sugar laboratory and since 1907 chemist in charge of the New York Sugar Trade Laboratory, Inc., has been appointed chief of the Bureau of Chemistry. The appointment is expected to take effect this fall. W. G. Campbell, acting chief of the bureau since 1920, has been appointed Director of Regulatory Work for the Department.

Dr. M. A. Jull, head of the poultry department at Macdonald College, has been appointed chief of the poultry division, Bureau of Animal Industry, beginning July 1.

Dr. O. E. Baker, agricultural economist of the Bureau of Agricultural Economics, has been appointed professor of agricultural geography for the ensuing year in Clark University.

American Association of Agricultural College Editors.—The eleventh annual conference of this association was held at Rutgers College June 25–28. The attendance was the largest in the history of the association, nineteen States being represented in addition to the U. S. Department of Agriculture. In the competitive exhibit of publications and other illustrative material, Ohio State University ranked first in the total number of points secured, Cornell University second, and the New Jersey College of Agriculture third. The association voted to hold its next conference at the South Dakota College.

Canadian Society of Technical Agriculturists.—The third annual convention of this society was held at the University of Saskatoon June 20–23. It was preceded by the annual meeting of the Canadian Association of Seed Producers and followed by a conference of the superintendents of the experimental farms of western Canada. A series of conferences organized by the Canadian Department of Agriculture were held under the leadership of Drs. F. J. Alway on soils, H. K. Hayes on cereals, A. J. Pieters on forage crops, and W. W. Swanson on rural economics.

The society conferred the title of "companion" on Dr. James W. Robertson, the previous recipients being Drs. L. S. Klinck and C. E. Saunders. The 1924 convention is to be held at Guelph, Ontario, in connection with the celebration of the fiftieth anniversary of the establishment of the Ontario Agricultural College.

World's Poultry Congress.—Announcement is made that the second World's Poultry Congress and Exhibition is to be held at Barcelona, Spain, May 10–18, 1924. The congress is to be held under the auspices of the International Association of Poultry Instructors and Investigators. Additional information concerning it may be obtained from Dr. G. F. Heuser, secretary of the American Association of Instructors and Investigators in Poultry Husbandry, Cornell University, Ithaca, N. Y.

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EXPERIMENT STATION RECORD.

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RECENT WORK IN AGRICULTURAL SCIENCE.

AGRICULTURAL CHEMISTRY—AGROTECHNY.

Distribution of pentosans in the corn plant at various stages of growth, J. H. VER HULST, W. H. PETERSON, and E. B. FRED (*Jour. Agr. Research [U. S.], 23 (1923), No. 8, pp. 655–663*).—A study is reported from the Wisconsin Experiment Station of the content of pentosans, methyl pentosans, and free pentoses in the corn plant at various stages of growth, and of the fermentation of the pentosans of green corn fodder by pure cultures of a number of organisms. Corn of the variety known as Golden Glow was planted in the greenhouse on January 15 and the plants harvested in eight series, beginning at 18 and ending at 137 days after planting. The various parts of the plant were thoroughly washed, dried, and weighed, subsamples dried over night at 105° C. in an electric oven, and duplicate 1-gm. samples used for the determination of pentosans by the Kröber method (E. S. R., 13, p. 320) and for methyl pentosans by the method of Ellett (E. S. R., 16, p. 948).

The data, calculated on the basis of 100 plants, show a variation in the pentosan content in different parts of the plant and a steady increase both in the actual weight and percentage during growth. From 7.4 per cent in the corn kernel the amount of pentosans had increased at the second stage of growth (31 days) to 11.6 per cent in the tops and 19.5 per cent in the roots. From this stage to maturity there was only a slight increase in the percentage of pentosans in the roots, but a marked increase in the tops. As each part of the plant developed there was a rapid increase in its pentosan content, especially in the cob which showed an increase of from 9 to 32 per cent. Only 0.37 per cent of methyl pentosans was found.

Free pentoses were found in the corn plant at all periods of growth, the maximum percentage (1.7 per cent of the dry matter) being found in the stalk at the time when the kernels were forming.

Pure cultures of various organisms, including one isolated from soil, three from sauerkraut, one from silage, one from green corn, *Bacillus flavigena* and another cellulose-fermenting organism, *Streptococcus lactis*, and *B. coli communis*, fermented green corn stover in varying degrees. The maximum destruction, 12.8 per cent, was obtained with *B. flavigena* and nearly as great with *B. coli communis* and the organism isolated from green corn tissue.

Composition of corn pollen.—II, Concerning certain lipoids, a hydrocarbon, and phytosterol occurring in the pollen of white flint corn, R. J. ANDERSON (*Jour Biol. Chem., 55 (1923), No. 4, pp. 611–628*).—Essentially noted from another source (E. S. R., 49, p. 12).

Iron and manganese content of certain species of seeds, J. S. McHargue (*Jour. Agr. Research [U. S.], 23 (1923), No. 6, pp. 395–399*).—The author reports the iron and manganese content of the seeds of a number of varieties of wheat, oats, garden peas, garden beans, soy beans, clovers, grasses, sunflowers, hemp, flax, rape, and tobacco procured from different parts of the country.

The average manganese content of the seeds of wheat and oats produced under normal conditions in the soil is said to be equal to the average amount of iron found in the seed. The amount of manganese in the seeds of legumes is much less than the iron content. In the grasses and miscellaneous seeds examined the amount of iron and manganese showed considerable fluctuations.

Attention is called to the fact that the capacity of the wheat plant for storing manganese in the seed is as great as its capacity for storing iron, and this is said to suggest the possibility that manganese may perform a function of equal importance to that of iron in the plant's metabolism.

In discussing these results with reference to the value of iron and the probable value of manganese in nutrition attention is called to the relatively high iron content of garden peas and beans and soy beans, and of the high manganese content of oats. While wheat and oats have about the same content of manganese, it is pointed out that oatmeal, as prepared for human consumption, is a much richer source of manganese than the ordinary patent flour on account of the fact that in wheat the manganese occurs in greatest concentration in the outer membranes of the seed and is consequently removed in milling.

The chemists' yearbook, 1923, edited by F. W. Atack and L. Whinyates (*New York: Chem. Catalog Co., Inc.; Manchester, Eng.: Sherratt & Hughes, 1923, Amer. ed., pp. XIII+1093+[17], figs. 27*).—This is the first American edition of this well-known English yearbook for chemists, an earlier edition of which has been noted previously (E. S. R., 46, p. 9). In this revision to suit the needs of American chemists the authors have had the collaboration of F. Turner, jr.

Filtration, C. L. Bryden and G. D. Dickey (*Easton, Pa.: Chem. Pub. Co.; London: Williams & Norgate, 1923, pp. XII+376, figs. 264*).—This volume deals with the principles and history of filtration; various types of filters, with illustrations and descriptions of construction, operation, and application of each; coagulants, filter aids, and filter media; operating data; and auxiliary equipment. Miscellaneous information of use in the operation of filter plants is given in an appendix.

A modification of Gillespie's method for the determination of H-ion concentrations, W. D. Hatfield (*Jour. Amer. Chem. Soc., 45 (1923), No. 4, pp. 940–943*).—In this modification of the Gillespie method for determining H-ion concentration (E. S. R., 43, p. 11), the disadvantage in the instability of the color standards of the original method is overcome by the use, in place of dilute acids and alkalis, of a buffer solution prepared from ordinary C. P. salts. Directions are given for making up the indicator solutions and standards.

The valuation of insoluble phosphates by means of a modified citric acid test, G. S. Robertson and F. Dickinson (*Jour. Soc. Chem. Indus., 42 (1923), No. 8, pp. 59 T–66 T, fig. 1*).—In this paper, presented at a meeting of the London section of the Society of Chemical Industry, data are given on the analysis of basic slags and rock phosphates by the original Wagner citric acid solubility test in which 5 gm. of the material is shaken with 500 cc. of 2 per cent citric acid for half an hour in an end-over-end shaker, making 30 r. p. m., and by a modification of this test, using 1 gm. instead of 5 gm. of the material. A comparison is also reported of the results of previously-noted field experi-

ments in which many types of rock phosphates and basic slags had been used as fertilizers (E. S. R., 45, p. 521) and the citric solubility values of these fertilizers as determined by the official (5 gm.) and modified (1 gm.) citric solubility tests.

In the latter comparison the 1 gm. solubility figures gave a much closer approximation to the field results than those obtained by the official method.

In the case of the various basic slags and rock phosphates, the results obtained with 1 gm. of material were higher than with 5 gm. This was particularly marked in the case of the rock phosphates, citric solubility figures of from 45 to 90 per cent being obtained with the modified method as against from 20 to 40 per cent with the original method. The modification is recommended as giving results which are more in accordance with field results and as enabling closer distinctions to be made between phosphates of varying solubilities.

Reports are included of a discussion of the paper by B. Dyer, H. J. Page, A. More, J. Golding, W. R. Ormandy, and E. Gardner.

The determination in soils of presumably assimilable phosphoric anhydrid, C. Ravenna (*Gior. Chim. Indus. ed Appl., 5 (1923), No. 3, p. 129*).—A brief description is given of a modification of the Dyer method for the determination of available phosphoric acid in soils (E. S. R., 5, p. 1009). The principal feature of the modification consists in the elimination of the citric acid by heating with concentrated nitric acid in the presence of a manganese salt in place of ashing it. The technique is as follows:

A 75-gm. sample of the soil, dried at 110° C., is placed in a liter flask suitable for use in a rotating apparatus and sufficient powdered citric acid is added to decompose the lime, or about 1.4 gm. for each gram of lime, after which 750 cc. of a 1 per cent solution of citric acid is added with shaking. After the evolution of CO_2 has ceased, the flask is stoppered and shaken for 6 hours, the contents then filtered, and 500 cc. of the filtrate evaporated to dryness on a water bath. The residue is transferred to a Kjeldahl flask with 50 cc. of nitric acid, specific gravity 1.4, and a pinch of manganese carbonate. The digestion is continued, with further additions of nitric acid if necessary, until the effervescence and the development of a rose color cease. The liquid is then evaporated on a water bath to render the silica insoluble, and the determination continued as in the usual method.

The determination of sulphur in organic compounds, W. F. Hoffman and R. A. Gortner (*Jour. Amer. Chem. Soc., 45 (1923), No. 4, pp. 1033–1036*).—The authors have applied the Denis modification [1] of the Benedict method of determining sulphur in body fluids [2] to sulphur determinations in a large number of organic compounds, and report its applicability for all such compounds which are not volatile and do not sublime.

The electrometric titration of reducing sugars, W. L. Daggett, A. W. Campbell, and J. L. Whitman (*Jour. Amer. Chem. Soc., 45 (1923), No. 4, pp. 1043–1045*).—Directions are given for using electrometric titration methods for obtaining the end point in the volumetric determination of reducing sugars with Fehling solution.

The apparatus required consists of a normal calomel electrode, a common type of adjustable resistance for the main circuit, a miniature millivoltmeter, a commercial type of galvanometer, and a motor-driven stirrer. The Fehling solution was made up according to Leach except that in the alkaline tartrate solution only 50 gm. of sodium hydroxid was used per liter. To exactly 10 cc. of the standard copper sulphate solution A were added an equal amount of

[1] Jour. Biol. Chem., 8 (1910), No. 5, pp. 401–403.
[2] Jour. Biol. Chem., 6 (1909), No. 4, pp. 363–371.

solution B and 50 cc. of distilled water. The mixture was brought to boiling and the sugar solution added rapidly until the end point was reached, as judged by the large deflection of the galvanometer and the large change of resistance required to bring it to zero. The results obtained by this method have been checked gravimetrically. The theoretical weight of cuprous oxid, as calculated from the electrometric determination, was 0.1966 gm., while the actual amount obtained by weighing the precipitate in a Gooch crucible was 0.1969 gm.

It is stated that no work has as yet been done on the determination of very small amounts of reducing sugars or upon the effect of the presence of large quantities of other sugars such as sucrose.

The determination of the milk content of milk chocolate, J. GROSSFELD (*Ztschr. Untersuch. Nahr. u. Genussmtl., 44 (1922), No. 5, pp. 240–244*).—Three methods are recommended as suitable for determining the milk content of milk chocolate. The simplest is considered to be the determination of the total ash and calcium content, from which the milk protein is calculated from the formula milk protein=26.1 × percentage of CaO —1.16 × percentage of total ash. Similarly milk protein can be determined from the calcium and total nitrogen of the chocolate, the formula in this case being as follows: Milk protein =21.4 × percentage of CaO —1.35 × percentage of total N. The third method consists of the determination of the casein content of the chocolate.

For determining calcium oxid in connection with total ash, the following method is recommended: A 20-gm. sample of the chocolate is ashed in a platinum dish in the usual way. After the ash has been weighed it is treated with 20 cc. of 25 per cent phosphoric acid to dissolve the calcium oxid and then with 20 cc. of 2 per cent ammonium oxalate solution, and, after stirring, with 20 cc. of 10 per cent sodium hydroxid. At the same time a blank is prepared of the reagents alone. Both are allowed to stand until cool and are then filtered through kieselguhr, after which 20 cc. of 1:3 sulphuric acid is added to 50 cc. of each filtrate and the solution titrated with N/10 potassium permanganate.

Data are given on the milk protein of 18 samples of milk chocolate as determined by the three methods. In general satisfactory agreement was obtained.

The examination and evaluation of milk chocolate, F. HÄRTEL and F. JAEGAR (*Ztschr. Untersuch. Nahr. u. Genussmtl., 44 (1922), No. 6, pp. 291–317. figs. 3*).—This paper discusses the standards to which full milk and skim milk chocolate should conform, describes in detail the methods to be employed for the necessary determinations, and presents data on the composition of standard milk chocolate.

It is considered that a true milk chocolate should contain 20 per cent of full-milk solids and a skim-milk chocolate 15 per cent of skim-milk solids. Both should contain at least 30 per cent of cacao.

The content of milk fat in the chocolate is calculated by dividing the product of the Reichert-Meissl number and fat by 30. This value should be at least 3.1 per cent. For estimating the content of full milk powder the standards for the powder are fixed as 25 per cent of milk fat, from 20 to 22 per cent of casein, and 35 per cent of lactose, the ratio of casein to fat being 1:1.25 and of milk fat to lactose 1:1.4.

The casein is determined in the fat-free residue of the chocolate by solution in sodium oxalate and precipitation with uranium acetate and acetic acid. A milk chocolate containing 12.5 per cent of whole-milk powder should contain 2.5 per cent of casein.

The amount of lactose is determined by the reduction of Fehling's solution, and of sucrose by subtracting this value from the value of the total sugars obtained by polarization.

The crude fiber is determined by digesting the material with N nitric acid and then with 1 per cent sodium hydroxid, after which the insoluble residue is collected on a sand filter, dried, and weighed. The amount of cacao bean is calculated by assuming that the bean contains from 3 to 4 per cent of crude fiber.

The urea content of cow's milk.—A simple method of determining urea, Y. MORIMOTO (*Jour. Biochem., 1 (1922), No. 1, pp. 69–81*).—The method employed in the reported determinations of urea in cow's milk involves the use of the hypocotyl of the jack bean as a source of urease as recommended by Nagasawa, and casein as an indicator for determining the end point of the reaction. The urease solution is prepared by mixing 1 gm. of the finely ground hypocotyl with 100 cc. of a mixture of glycerine and water 4:1, and shaking the mixture for 3 hours at from 35 to 40° C. in a shaking apparatus. From 6 to 7 cc. of N/2 HCl is then added, and the mixture is shaken for an hour more and filtered through paper pulp. The clear solution thus obtained is said to retain its activity for more than 6 months at room temperature.

In determining the urea content of urine, from 3 to 5 cc. of the urine is diluted in a 250 or 300 cc. flask with 500 cc. of water, and to the solution are added 3 cc. of the urease solution and 1 cc. of 3 per cent calcium caseinate. The flask is quickly closed with a rubber stopper fitted with a tap funnel and is immersed in a water bath at 38° for 3 hours, after which it is placed in cold water and a measured amount of N/10 HCl, generally 40 cc., is added cautiously through the tap funnel. The contents of the flask are well mixed, and the excess acid is titrated with N/50 NaOH until the casein begins to precipitate. In determining the urea content of milk, a 10-cc. sample is diluted with 40 cc. of water and digested with 3 per cent of the urease solution.

Data are reported on the urea content of samples of urine with and without the addition of urea and of milk obtained from 38 cows in various stages of lactation and on various rations.

The extreme variations obtained for the urea content of cow's milk were 0.012 and 0.042 gm. per 100 cc., but in most cases the values were between 0.025 and 0.035, with an average of 0.032 gm. per 100 cc. Lower values were obtained for pasteurized than fresh milk and higher values for the milk of cows immediately after calving than for normal milk. The urea average content of 4 samples of goat's milk was 0.085 gm. per 100 cc.

The determination of acids in silage, W. ZIELSTORFF and F. BENIRSCHKE (*Chem. Ztg., 46 (1922), No. 124, p. 939*).—This is a brief discussion of certain points which the authors have found necessary to observe in determining the acidity of silage.

In preparing the extract to be tested, a 100-gm. sample of the finely divided material is heated with distilled water in a 2-liter flask under a reflux condenser for 3 hours, after which it is cooled, diluted to the mark with distilled water, and filtered through a filter cloth. To decolorize the filtrate as completely as possible, 100 cc. is heated for a few minutes with some kieselguhr under a reflux condenser and filtered through folded filter paper. The filtrate is made up to 200 cc., and an aliquot is used for the determination of total acidity. If the filtrate is still strongly colored, it has to be further diluted with water in order that the color with phenolphthalein on titration with the base be visible. The titration should be conducted while hot and the base diluted corresponding to the acid, an N/50 solution being used.

In determining the bound volatile acids, the authors note that in some cases the filtrate still gives an acid reaction after prolonged distillation with steam.

Similar difficulties were encountered whether phosphoric acid or sulphuric acid was used to set free the volatile acid.

The determination of acids in silage, E. Grasemann (*Chem. Ztg., 47 (1923), No. 19, pp. 134, 135*).—In reply to the above note, the author outlines his method of determining acids in silage. The extract is prepared in the cold by allowing 100 gm. of the material to stand in 1 liter of water at room temperature for 12 hours, 1 cc. of 37 per cent formaldehyde solution being added to inhibit the action of microorganisms during this period.

In connection with the determination of free volatile acids, attention is called to the observation that at the end of the distillation of the acid extract with steam, the ratio of acid vapor to water vapor can be expressed by the formula

$$k=\frac{\log y_1-\log y_2}{\log x_1-\log x_2}$$

in which y_1 and y_2 represent, respectively, the amounts of acid at the beginning and the end of the distillation and x_1 and x_2 the corresponding amounts of water. The constant k, which is characteristic for each acid, is 0.66 for acetic acid and 1.91 for butyric acid. Examples are given of the application of these values to the determination of the relative proportion of these acids in silage extracts.

In determining the bound volatile acids, the extract is treated with either normal sulphuric or phosphoric acid, the latter being considered preferable.

The use of an absorbing agent for decolorizing the extract, as recommended by Zielsdorff and Benirschke, is considered inadvisable on account of the possibility that some of the organic acids, as well as the coloring matter, may be absorbed. Titration while hot is also criticized, as possibly bringing about some changes in the system which would affect the results.

Pear by-products, J. H. Irish (*California Sta. Circ. 259 (1923), pp. 4*).—This circular gives directions for utilizing sound cull pears in the preparation of pear spread, vinegar, sirup, and candy. Methods for making the first three of these products have been noted previously from another source (E. S. R., 47, p. 613). For use as a candy it is suggested that pear spread be combined with apple pectin, boiled to 224° F., and the jellied product coated with fondant or chocolate or both. Another confection is prepared by dipping soft pliable dried pears in melted chocolate and placing them on waxed paper to harden.

It is estimated that at present the cull pears in the State of California amount to 15,000 tons annually.

Mannose from white spruce cellulose, E. C. Sherrard and G. W. Blanco (*Jour. Amer. Chem. Soc., 45 (1923), No. 4, pp. 1008–1013*).—This contribution from the U. S. Forest Products Laboratory, Madison, Wis., reports experimental evidence leading to the conclusion that mannose is present in cellulose in a combined state and is attached to the cellulose residue in much the same way as is a portion of glucose.

Glue and gelatin, J. Alexander (*New York: Chem. Catalog Co., Inc., 1923, pp. 236, pl. 1, fig. 1*).—This volume, which is one of the series of monographs edited by the American Chemical Society, deals with the chemistry and technology of gelatin and glue. The literature references are given throughout in the form of footnotes. An appendix contains a description of the tentative methods for testing glue and gelatins as prepared by the National Association of Glue and Gelatin Manufacturers, and a description, with illustration and working directions, of the Bloom gelometer for determining the jelly strength of glues and gelatins.

Synthetic resins and their plastics, C. ELLIS (*New York: Chem. Catalog Co., Inc., 1923, pp. 514, figs. 88*).—A synthetic resin is defined in the introduction to this volume as "a complex amorphous organic semisolid or solid material, usually a mixture of substances built up by chemical reaction and approximating the natural resins in various physical properties, namely, luster, fracture, comparative brittleness at ordinary temperatures, insolubility in water, and fusibility or plasticity when heated or exposed to heat and pressure, but commonly deviating widely from natural resins in chemical constitution and behavior with reagents." Synthetic resins as thus defined are further classified into two groups. Group A consists of resins which are made essentially by the reaction of nonresinous substances with a resinifying agent; and group B of the resins made by the reaction of natural resins with various chemical reagents which modify their composition and products. Among the resins of group A are the phenol-formaldehyde products, such as bakelite, cumaron resin, glycerin and phthalic-acid condensation bodies, ketone resins, the products of polymerization of vinyl compounds, urea and thiourea derivatives, and the sulphur-phenol resins. Included in group B are the metallic resinates and the resin esters or ester gums. All of these are discussed in the present volume, although prominence is given to the cumaron resins and the condensation products of phenol and formaldehyde.

The industrial application of the synthetic resins in varnish making, and particularly in plastic molding composition, is considered in detail. The final chapter includes the standard methods of testing molded insulating materials adopted by the American Society of Testing Materials. Throughout the volume extensive references to the literature are given as footnotes.

METEOROLOGY.

Monthly Weather Review (*U. S. Mo. Weather Rev., 51 (1923), Nos. 1, pp. 54, pls. 13, figs. 11; 2, pp. 55–109, pls. 15, figs. 52*).—In addition to detailed summaries of meteorological, climatological, and seismological data and weather conditions for January and February, 1923, and bibliographical information, reprints, reviews, abstracts, and minor notes, these numbers contain the following contributions:

No. 1.—History of Radio in Relation to the Work of the Weather Bureau, by E. B. Calvert; Meteorological Stations in High Latitudes, by F. Stupart; Frequency Distributions of Daily and Hourly Amounts of Rainfall at Galveston, Tex. (illus.), by I. R. Tannehill; Lowering of Kansas River Channel at Topeka, Kans. (illus.), by S. D. Flora; Snowfall and the Run-off of the Upper Rio Grande (illus.), by C. E. Linney; Frankenfield on the Spring Floods of 1922 (illus.), by A. J. Henry; Frost-fighting in the Pecos Valley, by C. Hallenbeck; and A Climatological Calendar for Columbia, Mo., by G. Reeder.

No. 2.—A Statistical Study of Surface and Upper-air Conditions in Cyclones and Anticyclones Passing Over Davenport, Iowa (illus.), by A. D. Udden; Brazilian Meteorological Service (1921–1923), by J. de S. Ferraz; Pretechnical Meteorological Studies, by H. E. Simpson; Values of the Solar Constant, 1920–1922 (illus.), by C. G. Abbot et al.; Dense Fog in the Tri-cities on November 1, 1922, by E. E. Unger; Windstorm at Independence, Calif., February 12, 1923 (illus.), by C. D. Asher; and Predicting Minimum Temperatures, by W. J. Bennett.

The winter snowfall of 1922–23 in the United States, C. F. BROOKS (*Bul. Amer. Met. Soc., 4 (1923), No. 4, p. 60*).—The outstanding features of the snowfall throughout the country during the winter of 1922–23 are briefly summarized.

The snowfall of New England and New York was excessive, and there were unusually heavy snowfalls in early February in the region of the South extending from Knoxville to San Antonio and in the Puget Sound region in December and February. "The western mountains received heavy snowfall, 8 to 12 ft. per month, as usual, the snow on the ground accumulating to depths of 6 to 12 ft. in many parts of the Rocky Mountains, Cascades, and Sierra Nevadas."

Meteorological observations at the Massachusetts Agricultural Experiment Station, J. E. OSTRANDER and G. E. LINDSKOG (*Massachusetts Sta. Met. Buls. 411–412 (1923), pp. 4 each*).—Summaries of observations at Amherst, Mass., on pressure, temperature, humidity, precipitation, wind, sunshine, cloudiness, and casual phenomena during March and April, 1923, are presented. The data are briefly discussed in general notes on the weather of each month.

The climate and weather of Vermont, F. E. HARTWELL (*Vermonter, 27 (1922), No. 9, pp. 211–214, pl. 1; abs. in Bul. Amer. Met. Soc., 4 (1923), No. 4, pp. 58, 59*).—This is a popular account of the essential facts regarding the characteristics and modifying conditions of the weather and climate of the region.

Vermont is within the area upon which a large proportion of the storm tracks of the country converge. Sunshine is relatively low; precipitation ample and well distributed. The temperature varies widely. The winters are rigorous, but cold waves are not excessive in number or severity. Lake Champlain has a marked effect in moderating the temperature and lengthening the growing season in the western part of the State. There is an average growing season of 160 days in the immediate vicinity of the lake.

A short bioclimatic study in the Egyptian desert, C. B. WILLIAMS (*Egypt Min. Agr., Tech. and Sci. Serv. Bul. 29 (1923), pp. 20, pls. 11*).—Observations from August 3 to 10, 1922, inclusive, on the temperature of the air and soil, atmospheric moisture, evaporation, radiation, and wind at different places and under different conditions in a comparatively small area in a wadi or valley southeast of Cairo, about 7 miles from the Nile and 6 miles from the nearest cultivation, are briefly summarized and discussed.

The results show the wide variation in temperature, humidity, and other conditions over a small area at any given time. It was observed, for example, that the surface sand had a daily temperature change of 37° C. (from 17.5 to 58.2°), while the air shade temperature varied from 21.2 to 35.9°, and 12 meters in a cave the temperature varied from 24 to 25.4° only. In the sand "the maximum temperature at 1 cm. was 58.2° C. (136° F.), and the daily range at this depth was 36° C. At 28 cm. (just less than 1 ft.) the maximum was only 34.5° C. and the daily range 1.5° C. The sand temperatures below 30 cm. were not much affected by daily changes of air temperature.

It was noted that the plant *Reaumuria hirtella* found growing in the wadi was covered with small crystals of sodium chlorid. These absorbed water from the air when the relative humidity was above 74 per cent.

Comparison is made of the data recorded in these observations with those reported by Sinclair from the desert laboratory near Tucson, Ariz., which have been previously noted (E. S. R., 47, p. 415).

The climate of Algeria, V. DEMONTÈS (In *L'Algérie Economique. Algiers: Gouvt. Gén. Algérie, Dir. Agr., Com., et Colon., 1922, vol. 1, pp. 173–455*).—The subject is treated somewhat exhaustively from the standpoint of (1) theoretical climatology and (2) applied climatology.

The climatic characteristics of Algeria as regards barometric pressure, temperature, precipitation, evaporation, and wind are described in detail, with

a discussion of measures of protection against extreme conditions of the climate.

Under the head of applied climatology, the author discusses in some detail the conservation, distribution, and use of the available water supply in irrigation.

The drought in the Samara Government of Russia in 1921, D. SHCHUKIN (*Zhur. Optyn. Agron. IUgo-Vostoka (Jour. Expt. Ladw. Südost. Eur.-Russlands), 1 (1922), No. 1, pp. 21–30*).—This article, which is in Russian with a brief German summary, gives data regarding the unusually severe drought which prevailed in this region in 1921, comparing it with droughts of previous years. Like those of 1871, 1891, and 1911, the drought of this year extended over the second half of the summer and was disastrous even to such crops as potatoes, which are ordinarily relied upon to utilize the rainfall of the latter half of the summer to make a crop. In spite of the unusually severe conditions, however, a considerable crop of potatoes was obtained. The study of the meteorological history of previous years indicates that droughts extending throughout the summer are of infrequent occurrence.

SOILS—FERTILIZERS.

[Soil studies at the Washington Station], F. J. SIEVERS (*Washington Col. Sta. Bul. 175 (1922), pp. 40–44*).—Soil nitrate studies are said to have shown that the addition of straw following summer fallow tillage had a general depressing affect, which, while not very pronounced, was sufficiently in evidence to be of economic significance. The greatest reduction in nitrates and in yield was obtained where the moisture content in the surface soil was lowest, with practically no reduction where the surface soil moisture was maintained at a percentage optimum for nitrification. This is considered to emphasize the value of effective summer fallow. The field and laboratory experiments are said to have shown that the effect of straw is not as easily overcome when it is applied to the poorer soils. Yields of wheat were found to vary almost in direct proportion to the nitrate content of the soils under field conditions in the Palouse region of eastern Washington.

Studies of the effect of magnesium oxid dust on the soil when deposited in excessive quantities from a magnesite roaster showed that this material was changed to the carbonate form soon after its deposition. Where present in large amounts it produced an alkaline condition in the soil, and developed a crust of such physical consistency as to prevent young plants from penetrating it. Also, enough of the magnesium salt went into solution to produce a toxic effect for common agricultural plants. This destructive effect was most pronounced in closest proximity to the roaster and on those soils lowest in volume weight, especially muck and peat. Pot experiments with virgin soils from the injured region showed that light applications of magnesium carbonate might prove beneficial to plant development even though the soils were normally very productive.

Soil fertility problems in western Washington and problems of soil irrigation are also briefly outlined.

Soil problems [at the Adams, Wash., Substation], M. A. MCCALL (*Washington Col. Sta. Bul. 175 (1922), pp. 47–50*).—Data secured in summer fallow experiments from 1918 to 1921 are said to have shown that under droughty conditions an abundant supply of nitrate nitrogen, with a consequent heavy yield of straw, tends to reduce grain yields. Tillage experiments for moisture conservation are said to have shown conclusively that the earliest possible spring preparation of the summer fallow leads to a greater accumulation of nitrates than does preparation at a medium spring date, but that very early

preparation does not conserve appreciably more moisture than that at the medium date, provided the latter be before volunteer grain and weeds begin active growth. Four correlation tables made from data secured from 279 individual plats are given as a basis for these statements.

[**Soil studies at the Pusa Research Institute**], C. M. HUTCHINSON (*Agr. Research Inst., Pusa, Sci. Rpts., 1921–22, pp. 41, 42*).—Experimental plats for soil studies are described, and the results of investigations of the vertical distribution of nitrates and the influence of cultivation, rainfall, and applications of nitrate upon nitrification are briefly reported.

These showed that additions of sodium nitrate up to 240 lbs. per acre increased the amount of nitrification in the soil. More nitrate was found in the first 3 ft. of cultivated than of uncultivated fallow soil, but rain washed out more nitrate from the cultivated soil and left it poorer in nitrate than the uncultivated soil.

Studies on the mechanical analysis of soils, T. MIECZYŃSKI (*Pam. Państ. Inst. Nauk. Gosp. Wiejsk. Puławach (Mém. Inst. Natl. Polonais Écon. Rurale Puławy), 1 (1920), A, No. 1, pp. 24–40*).—This is a preliminary report of the progress of studies on methods for the mechanical analysis of soils, in which it is shown that the Atterberg method of dividing the soils into mechanical fractions is more suitable for characterizing the soils of Poland than methods hitherto used. It was found that the Atterberg method could be modified by introducing a different order in the fraction, thus shortening the time required for sedimentation analysis from 40 to 50 per cent. More water is used in this method, however.

The Iowa soil survey and field experiments, W. H. STEVENSON and P. E. BROWN (*Iowa Sta. Circ. 82 (1923), pp. 23, figs. 8*).—This is a brief, popular description of the soil survey and field experimental work conducted by the soils section of the station to furnish Iowa farmers with fundamental facts regarding the characteristics and needs of their soils.

The ultimate analysis of the mineral constituents of a Hagerstown silty clay loam soil and the occurrence in plants of some of the elements found (*Pennsylvania Sta. Bul. 176 (1922), pp. 18, 19*).—The results of preliminary work are said to have shown the presence of the rarer elements vanadium, chromium, molybdenum, zirconium, rubidium, caesium, and lithium in this soil. Barium and strontium were also found. It is stated further that orthoclase, from which the soils in this region have derived most of their potash, is practically nonexistent in this soil.

Soil physics studies with reference to cultivation by scarification, BORNEMANN (*Deut. Landw. Presse, 49 (1922), Nos. 47, pp. 321, 322; 50, pp. 343, 344; 51, p. 350, figs. 3*).—The results of a series of studies of the physical properties of scarified soils are briefly presented in this report, particular reference being made to those properties relating to fineness of crumb structure and density of stratification.

In cropping tests with winter wheat, it was found that the yield increased with the fineness of the crumb structure. Density of stratification had no influence on yield where the fineness of crumb structure was uniform. Germination occurred earlier in the more loosely stratified soils. The lengths of leaves were always greater on loose than on dense soils. The water capacity was greater the finer the crumb structure of the soils and the more loosely it was stratified. It was also greater with an impervious subsoil and when the moisture was added to the soil in the form of rain. A condition of equilibrium between adhesion and gravity was found to exist in soils saturated with moisture. It was further observed that colloidal material could be leached out of the experimental soil in spite of the fact that it was well supplied with lime.

Studies on swelling and shrinkage of soils with changes in moisture content indicated that density of stratification should be such that no swelling or shrinkage results from moisture changes.

When crumby loam soil was exposed to freezing conditions, no volume changes occurred and apparently the ice crystals formed mainly in the void spaces. The formation of so-called frost crumb structure was found to occur mainly on the surface of soil, and to penetrate only so deep as the frost itself penetrated. The condition of frost crumb structure is considered to approach the ideal cultural condition of soil.

Further studies showed that where loam or clay soils were pulverized in a dry condition they did not readily resume their firm shape, and that scarified clay soils were completely changed in character. However, the smallest particles comprising the frost crumb structure were found to be very densely stratified and similar to moistened and compressed loam or clay. These particles are concluded to be the nucleus of the structure of loam soils. This is thought to explain the fact that wheat plants suffer less injury through freezing in scarified soils than in ordinarily plowed soils.

Comment is also made on the superior heat-retaining powers and bacterial activities of scarified soils.

The influence of precipitation on soil composition and on soil organic matter maintenance, F. J. Sievers and H. F. Holtz (*Washington Col. Sta. Bul. 176 (1923), pp. 32, fig. 1*).—Studies of the influence of precipitation on the composition and maintenance of the organic matter content of slightly modified residual soils lying in the Columbia River Basin east of the Cascade Mountains in Washington are reported.

The mechanical analyses of the soils showed a higher content of silt and very fine sand than is generally found in soils from arid regions, while the low percentage of clay is said to be characteristic of all soils formed under conditions of limited precipitation. The percentage of silt in these soils varied in proportion to the precipitation. The nitrogen content varied in proportion to the precipitation, but the ratio between nitrogen and carbon remained practically constant, thus furnishing no support for the common contention that the organic matter in arid soils has a high nitrogen content. Variations in precipitation apparently had no influence on the percentage of total phosphorus and potassium in the soil. The calcium content of the soils was slightly influenced by precipitation. Variations in precipitation had little influence on the organic matter content of the subsoil. The nitrogen-carbon ratio of the subsoil for the entire region was slightly narrower than for the corresponding surface soil.

It is considered possible that in the extremely arid regions, where nitrogen losses through cropping are light, there may be sufficient free nitrogen fixation to provide for the maintenance or even increase of soil organic matter. In the most humid portion of the area studied the loss of nitrogen through cropping was found to be heavier, and free fixation could not be relied upon to maintain the supply. The further opinion is expressed that in the intermediate regions, where legumes are not adapted and fairly high yields of small grain are still produced, the maintenance of organic matter will be governed entirely by free nitrogen fixation.

Moisture in soils, N. A. Katchinsky (*Trudy Moskov. Oblastn. Selsk. Khoz. Opytn. Sta. (Works Moscow Regional Agr. Expt. Sta.) Bul. 1 (1922), pp. 96–111, 125, 126, figs. 2*).—Studies to determine the influence of relief, vegetation, and other influences, including impervious strata at depths of from 20 to 24 in., on the distribution of moisture in soils are reported. Soil samples were taken at the foot, middle, and top of a slightly declining western slope of

medium loam soil and in a young beech wood at the top of the slope. The samples were taken at depths of from 2 to 3 in., 6, 9, 16, 28, and 39 in.

The moisture content of the soil was found to increase as the slope declined. The wettest strata appeared to be the two upper and two lower strata, while the middle strata were drier, the minimum moisture content being observed at a depth of 9 in. This condition is attributed to the retention of rain water by the top soil, to the moistening of the subsoil by lateral percolation along sloping, impervious strata, and to the drying influence of plant roots on the middle strata or subsurface soil.

Less moisture was found in the woodland soil than in the cleared soil, especially in the lower strata at a depth of 39 in. Soil covered with leaves was drier at a depth of 6 in. than at a depth of 9 in.

Lysimeter studies of the water régime of ashy loam soils. W. W. GEMMERLING (*Trudy Moskov. Oblastn. Selsk. Khoz. Opytn. Sta.* (*Works Moscow Regional Agr. Expt. Sta.*) *Bul. 1* (*1922*), *pp. 85–95, 124, 125, figs. 4*).—Studies begun in 1919 of the movement of water in loam and sandy loam soils are reported.

It was found that the lower strata of loam soils are moistened by water seeping down from higher strata and by water percolating laterally along impervious sloping strata as well as by rain. Rain was found generally to moisten only the upper part of the stratum containing humus, and the lower strata were moistened chiefly by water percolating laterally. A stratum was found to exist between the humus-bearing stratum and the subsoil which is not moistened by rain or water percolating laterally. Part of the dryness occurring in the two former strata is attributed to the interference of the latter stratum. In normally wet years the lower strata are moist, to which the oxidation processes occurring therein and resulting in blue and rusty spots are attributed.

Decomposition of kaolin by organisms. W. J. VERNADSKY (*Compt. Rend. Acad. Sci.* [*Paris*], *175* (*1922*), *No. 11, pp. 430–432; abs. in Jour. Soc. Chem. Indus., 41* (*1922*), *No. 21, p. 869A*).—Experiments are reported in which siliceous diatoms, together with a large number of unnamed bacteria, were placed in contact with clay in a nutritive medium containing no silicon. The development of the organisms proceeded rapidly, with the formation of free aluminum hydrates. In a control with sterile medium no change was observed in the clay. It is suggested that this decomposition of silicate may be of considerable importance in natural soil processes. The importance of further determining whether this chemical action is produced by the bacteria, the diatoms, or by their symbiosis is emphasized.

A preliminary survey of the soil fauna of agricultural land. P. BUNKLE (*Ann. Appl. Biol.*, *8* (*1921*), *No. 3–4, pp. 135–145*).—Studies conducted at the Victoria University of Manchester on the influence of cultivation on the fauna of continuously cultivated soils, pasture soils which had not been broken for at least three years previously, and permanent pasture soils are reported.

The distribution and numbers of the soil fauna were found to be more stable in grass than in arable soils. There was a corresponding increase in the fauna of both grass and arable soils as vegetative growth increased. The fact that the increase in numbers of fauna in arable soils always lagged behind the increase in grass soils is taken to indicate that grass soil is the source of the influx of fauna to arable soil during the growing season. No fauna characteristic of arable land was established, and the predominant species are those commonly found in pasture soils. A schedule of the species of fauna studied and a bibliography are appended.

Influence of soil reaction on earthworms, O. ARRHENIUS (*Ecology, 2 (1921), No. 4, pp. 255–257*).—Studies conducted in Java and at the University of California are briefly described, the results of which are taken to indicate that the presence or absence of earthworms in the soil is dependent upon its reaction, which in turn determines the soil type. It was found that earthworms could live only in slightly acid and neutral soils.

Stimulating the growth of Azotobacter by aeration, O. W. HUNTER (*Jour. Agr. Research [U. S.], 23 (1923), No. 8, pp. 665–677, figs. 4*).—Studies conducted at the Kansas Experiment Station to develop a method for inducing a prompt growth of Azotobacter in liquid media are reported.

The results showed that a prompt and vigorous growth of Azotobacter can be induced in large quantities of liquid medium by sufficient aeration. Aeration also stimulated rapid nitrogen fixation by Azotobacter. A close correlation was found to exist between the rate of dextrose fermentation and nitrogen fixation. The presence of calcium carbonate was not essential in a medium used for aerating pure cultures of Azotobacter.

[Soil bacteriological studies at the Idaho Station] (*Idaho Sta. Circ. 30 (1923), pp. 7, 8*).—Investigations of forest soil are said to have shown that ammonia and nitrate accumulations in this soil are retarded in amounts varying from 5 to 60 per cent by applications of sawdust, needles, cones, bark, and other tree products. The greatest retardation resulted from the application of cedar sawdust and needles. Maple sawdust was second in order of toxicity. Nitrogen fixation was greatly decreased by some of the products and practically eliminated by others.

A new nitrogen-fixing bacillus, G. TRUFFAUT and N. BEZSSONOFF (*Compt. Rend. Acad. Sci. [Paris], 175 (1922), No. 14, pp. 544–546*).—A new bacillus which is active in fixing nitrogen in soils is described, which is called *Bacillus truffauti* after the senior author.

This is a small rod-shaped organism from 1.5 to 2μ long and 0.5 to 0.8μ in diameter. It is a gram positive, aerobic, spore bearing, motile organism resembling *Proteus vulgaris*. It liquefies gelatin and assimilates mannite, glucose, saccharose, levulose, and lactose, fixing atmospheric nitrogen in amounts of from 2 to 7 mg. per gram of carbohydrate assimilated, according to the sugar content of the medium. Nitrogen fixation increases as the sugar content decreases. It is an energetic denitrifier, acts as a diastase, and produces ethyl alcohol and acetic acid in liquid media. It is abundant in the soil and is capable of resisting a heat of 75° C. for 20 minutes.

Reduction of nitrates caused by seed as a possible factor in the economy of nitrogen in crop production, J. DAVIDSON (*Jour. Amer. Soc. Agron., 14 (1922), No. 9, pp. 338–354*).—Studies conducted by the U. S. D. A. Bureau of Chemistry are reported, the object of which was to obtain quantitative measurements of the possible extent of the reduction of nitrates by seed.

A reduction of nitrates was induced by seed under laboratory conditions. The quantity of seed, the basic radicles of the common nitrates, the concentration of the nitrate solution, and the depth of the liquid in which the seed were submerged did not essentially effect the course of the process within the limits of these experiments. At a temperature of about 50° F. the process of reduction was somewhat retarded, otherwise it followed its normal course.

Growing seedlings produced a smaller quantity of nitrites than seed which had been devitalized by heating. The most plausible explanation of this phenomenon seemed to be the competition between the growing seedling and the reducing organism, which are considered to be directly responsible for the reduction of nitrates for nutrients stored up in the mother seeds. Young seedlings induced reduction of nitrates when grown in soil. Seed devitalized by

heating, as well as that naturally sterile, produced an appreciably larger quantity of nitrites than the growing seedlings under the same conditions. Actual loss of nitrogen was demonstrated as a result of reduction of nitrates caused by seed.

[Fertilizer tests at the Pennsylvania Station] (*Pennsylvania Sta. Bul. 176 (1922), pp. 6–7*).—The progress results of several years of fertilizer tests are briefly presented. It is stated that in a field test of different carriers of phosphates the wheat on plats receiving phosphorus in acid phosphate was ripe five days earlier than that on plats receiving no phosphorus, and from three to four days earlier than that on plats receiving phosphorus in rock phosphate.

Lime requirement studies on the general fertilizer plats are said to have indicated a pronounced variation in lime requirement, bearing a close relationship to topography, soil type, approach of the underlying limestone to the surface, and irregular stand of clover.

Fertilizers and crop rotations [at the Irrigation Substation], R. P. Bean (*Washington Col. Sta. Bul. 175 (1922), pp. 52, 53*).—Data on fertilizer and crop rotation experiments begun on new land with potatoes are briefly presented.

Instructions for the use of fertilizers (*Instrucciones para el Empleo de los Abonos. Barcelona: Soc. Anónima Cros, 6. ed., pp. 75*).—This pamphlet contains general information on the composition, selection, and use of fertilizers, and gives specific instructions as to the fertilizer treatment of certain crops with particular reference to Spanish agricultural conditions. Brief information is also included on the sampling and analysis of commercial fertilizers and on the important features of the fertilizer inspection laws of Spain.

[Report on nitrogenous fertilizers], C. Matignon (*Ann. Sci. Agron. Franç. et Étrangère, 39 (1922), No. 6, pp. 313–332*).—This is a report presented to the French Fertilizer Commission on the needs of French agriculture for nitrogenous fertilizers, the capacity for their production, and the development of the nitrogenous fertilizer industry in France.

It is stated that the annual agricultural requirements for nitrogenous fertilizers in France reach a minimum of 140,000 tons of combined nitrogen. During the agricultural year 1921–22 France imported 82 per cent of the nitrogenous fertilizers consumed. The importance of rapid development in the manufacture of synthetic nitrogenous fertilizers is emphasized.

Ground mineral phosphates as manures, D. A. Gilchrist (*Jour. Min. Agr. [Gt. Brit.], 29 (1922), No. 8, pp. 706–710*).—In a contribution from the Armstrong College a summary is given of results from different English sources on the fertilizer value of ground mineral phosphates, particularly for pasture and grasslands.

Some compounds in the $CaO—P_2O_5$ system and their relation to Thomas slag, T. Dieckmann and E. Houdremont (*Ztschr. Anorgan. u. Allg. Chem., 120 (1921), No. 2, pp. 129–149, figs. 7*).—Studies of the compounds contained in Thomas slag and of other compounds in the $CaO–P_2O_5$ systems are reported.

Data on the specific weight, melting temperature, and citrate solubility of several compounds, including the so-called silicophosphate of Thomas slag, showed that the solubility of Thomas slag would be about the same if its phosphoric acid content was combined as triphosphate, tetraphosphate, or silicophosphate. It seemed important that any excess of free lime be combined with silica. While pure tribasic phosphate had not hitherto been found in Thomas slag, the studies indicated that the silicophosphate consists of tribasic calcium phosphate and calcium orthosilicate. It is concluded that the high fertilizer

value of Thomas slag is dependent mainly upon the solubility of its content of tricalcium-silicophosphate produced by slow cooling.

The accessory elements of phosphatic slags, A. Demolon (*Compt. Rend. Acad. Sci.* [*Paris*], *174* (*1922*), *No. 26, pp. 1703–1706, fig. 1*).—The substance of this report has been previously noted from another source (E. S. R., 47, p. 623).

Solution of the phosphoric acid problem in low value lands, P. Krische (*Ztschr. Angew. Chem., 36* (*1923*), *No. 18, pp. 130–134*).—A brief discussion of the shortage of phosphoric acid fertilizers in Germany is presented, together with a summary of the results of studies on the subject and a description of such phosphates and substitutes therefor as are available.

The availability of potassium in orthoclase for plant nutrition (*Pennsylvania Sta. Bul. 176* (*1922*), *p. 13*).—The results of chemical studies with buckwheat plants grown in washed sand containing varying amounts of finely ground orthoclase are said to have shown that the plants grew better when the potassium was furnished in the form of orthoclase than when larger amounts of potassium were furnished by a complete nutrient solution. The amount of potassium, however, was higher in the plants grown in sand containing the complete nutrient solution. The presence of calcium carbonate and calcium sulphate when orthoclase was used increased the amount of potassium in the plant tissues. The presence of sodium chlorid increased the dry weight of plants, but seemed to reduce the amount of available potassium. Sodium sulphate had no effect on the availability of potassium.

[Lime for Michigan county soils] (*Michigan Sta. Circs. 55–60* (*1923*), *pp. 4 each, fig. 1 each*).—Maps of six counties in Michigan showing the lime requirements of the different soil types of each county are presented and discussed. These include St. Joseph County, 16 soil types, by M. M. McCool and L. C. Wheeting; Cass County, 25 soil types, by McCool and J. O. Veatch; Calhoun County, 23 soil types, by McCool and Veatch; Berrien County, 29 soil types, by McCool and Veatch; Ottawa County, 30 soil types, by McCool and Veatch; and Kalamazoo County, 25 soil types, by McCool, Veatch, and J. Tyson.

Lime report, 1921, J. W. Kellogg (*Penn. Dept. Agr. Bul. 365* (*1922*), *pp. 29*).—This is a report of the results of the official inspection of agricultural lime products in Pennsylvania during the spring and fall seasons of 1921, including analyses of 118 samples collected for inspection.

Agrologic study of manganese, P. Nottin (*Ann. Sci. Agron. Franç. et Étrangère, 6. ser., 37* (*1920*), *No. 3, pp. 228–232*).—Studies are reported which showed that when soluble manganese was introduced into a soil it became insoluble immediately, combining with humates and clay without attacking the calcium carbonate in the soil in the form of calcite. These compounds were dissolved slowly and became available to vegetation and soil microorganisms.

Sulphur as a plant food, J. L. St. John (*Washington Col. Sta. Bul. 175* (*1922*), *pp. 15, 16*).—Data obtained during the year from laboratory, greenhouse, and field experiments with sulphur are briefly presented, indicating that the application of elemental sulphur at rates of 160 and 500 lbs. per acre causes an accumulation of soil nitrates, while a 1,000-lb. application causes a decrease. Nitrate accumulation was decreased by the use of sulphur on manured soils. Sulphur oxidized fairly rapidly in the soils tested, and the rate of oxidation was affected but little by the addition of manure. Palouse soil seemed to contain more soluble sulphate than Lind soil.

The possibility of using town refuse as manure, J. Russell (*Jour. Min. Agr.* [*Gt. Brit.*], *29* (*1922*), *No. 8, pp. 685–691*).—In a contribution from the Rothamsted Experimental Station, a discussion is given of the fertilizer value of town refuse, including the contents of ash pits, night soil, street sweepings, and mixed refuse, consisting of night soil and ash-pit contents. Analyses of

prepared ash-pit refuse, enriched by mixing with a certain amount of street sweepings, slaughterhouse refuse, stable manure, etc., from different English cities, are also presented and discussed.

It is stated that, as far as present experience goes, the chief value of ash-pit refuse lies in its physical effect in lightening a heavy soil, and that any manurial action it may have is to be attributed to such animal or vegetable refuse as may be present. It is noted that winter deliveries of such materials contain a larger percentage of cinders and a smaller percentage of fertilizing animal and vegetable matter than the summer deliveries. An actual test to compare town refuse with barnyard manure when applied at the rate of 15 tons per acre to swedes gave results favorable to the barnyard manure, although apparently the refuse increased the crop.

Report on the fertilizer value of activated sludge, H. D. Brown (*Ontario Bd. Health Ann. Rpt., 39 (1920), pp. 130–155, figs. 9*).—Following a preface by F. A. Dallyn, the results of experiments conducted during 1920 as to the commercial value of activated sludge as a fertilizer are reported.

The purpose of these studies was to determine the availability of the nitrogen content of activated sludge and to compare it with other nitrogenous fertilizers on the market, including cyanamid, dried blood, sodium nitrate, ammonium sulphate, and tankage. The crops used were flax, potatoes, peas, beans, tomatoes, cauliflower, cabbage, carrots, seed onions, lettuce, and tobacco.

The results indicated that dried or activated sludge is very valuable as a fertilizer and can compete with other commercial fertilizers on the market. That used in the tests contained 4.5 per cent of nitrogen and 14 per cent of moisture. The nitrogen content was found to be readily available to plants, and the sludge was very beneficial when applied immediately prior to planting. A rapid early growth was obtained which exceeded that produced by any other fertilizer used. The maturity of the plants was hastened by sludge.

Gas water fertilization, T. Remy and F. Weiske (*Mitt. Deut. Landw. Gesell., 38 (1923), No. 8, pp. 106–108*).—Studies on the use of waste water from gas works as a fertilizer, owing to its relatively high ammonia content, are briefly reported.

The use of gas water as a top-dressing resulted in injury to crops, not only from the caustic action of the free ammonia but from the action of other toxic constituents. This injury was lessened by heavy rainfall, the prevalence of cool weather, or by dilution of the gas water. The injurious effects of the gas water disappeared after a few weeks, and were more than compensated for by the increased growth induced by the ammonia, which approximated that induced by ammonium sulphate. The increase in yield depended upon the extent of the injury and the action of the nitrogen, which in turn depended upon the volatility of the ammonia. The use of means for preventing nitrogen losses was beneficial. The profitable use of this material is said to be limited somewhat by the high cost of transportation. It is stated that the German gas works at Frankfort-on-the-Main produce annually 750,000 tons of gas water containing 10,500 tons of nitrogen.

Influence of carbon dioxid on the development of plants.—Use of carbon dioxid as an atmospheric fertilizer, R. Ceighelli (*Ann. Sci. Agron. Franç. et Étrangère, 6. ser., 38 (1921), No. 2, pp. 68–75*).—A review is given of the results of different studies on the subject. The conclusion is drawn that the use of carbon dioxid as a so-called atmospheric fertilizer has the same tendency as other fertilizers to increase crop yields. The problem now is to find out how it may be profitably used in general fertility practice.

Tests of radioactivity in Spain (*Estac. Cent. Ensayo Semillas, Madrid, Bol. Trimest., 1 (1921), No. 2, pp. 7, 8; abs. in Internatl. Inst. Agr. [Rome], Internatl. Rev. Sci. and Pract. Agr., 12 (1921), No. 11, pp. 1390, 1391*).—A brief report is presented of experiments conducted by J. Muñoz del Castillo at the University of Madrid on the influence of radioactive materials on the growth of crops. The chlorids of thorium and rhodium were used as radioactive materials. These were added to complete fertilizers singly and in combination.

The maximum effect of radioactivity, as indicated by the growth of maize, was obtained with additions of 30 gm. of thorium per hectare (26.7 lbs. per acre). Amounts greater than 30 gm. seemed to have a toxic effect, while amounts less than 30 gm. in some cases gave negligible results. The addition of thorium to rhodium even in small quantities seemed to increase the effect of the latter.

Electroscope for measuring the radioactivity of fertilizers, I. Curie (*Ann. Sci. Agron. Franç. et Étrangère, 39 (1922), No. 5, pp. 257–264, fig. 1*).—An electroscope for measuring the radioactivity of fertilizers is briefly described and the theory of its use outlined.

The toxicity of borax for vegetation, A. Bruno (*Ann. Sci. Agron. Franç. et Étrangère, 6. ser., 37 (1920), No. 2, pp. 185–190*).—A summary is given of the results of studies conducted in this country and in France on the toxicity of borax which may occur in commercial fertilizers.

Influence of fertilizers containing borax on the growth and fruiting of cotton, J. J. Skinner and F. E. Allison (*Jour. Agr. Research [U. S.], 23 (1923), No. 6, pp. 433–443, pls. 4*).—Experiments conducted by the U. S. Department of Agriculture to test the effect of borax in fertilizers on cotton at Arlington Farm, Va., and at Muscle Shoals, Ala., are reported. The Arlington Farm soil was a productive silt loam, and the Muscle Shoals soils were Clarksville loam and Colbert silt loam. Borax was mixed with fertilizers and applied so as to add 5, 10, and 20 lbs. of anhydrous borax per acre in two of the experiments. In a third experiment the quantities added varied from 1 to 400 lbs. per acre.

At both locations borax added in small quantities was injurious to the young plants. When fertilizer was broadcasted on the silt loam at Arlington Farm, 5 lbs. of borax per acre was not always injurious, 10 lbs. was slightly injurious, and 20 lbs. was distinctly so, reducing the weight of the green plants in the various plats from 15 to 35 per cent. When the fertilizer was applied in the drill and seed planted immediately, 5 lbs. was slightly harmful, 10 lbs. was distinctly injurious, and 20 lbs. caused severe injury, especially on germination and early growth. When the fertilizer was applied and allowed to stand until after a rain before the seed was planted, the effects were less severe.

Somewhat similar results were obtained on the loam soil at Muscle Shoals. In one of the experiments 5 lbs. of borax applied in the drill with the fertilizer decreased the green weight of the plants 5.7 per cent, 10 lbs. decreased it 12 per cent, and 20 lbs. 39 per cent. The injuries to early growth are said to have been much more marked than these figures would indicate.

Rainfall materially influenced the effect of borax, the most severe effect occurring wherever there was a light rainfall soon after planting, followed by a dry period. If heavy showers followed periodically after planting, the effect was less severe.

In an experiment started in the early spring on loam soil at Muscle Shoals, where the rainfall was very heavy for 10 days after planting, germination was materially affected where the borax was applied broadcast at the rate of 100 lbs. per acre, and no germination took place when 200 lbs. per acre was applied.

Where put in the row germination was materially affected by 50 lbs. per acre, and was prevented entirely by 100 lbs.

[Special and official fertilizer analyses], R. E. Rose and G. Hart (*Fla. Dept. Agr. Quart. Bul., 33 (1923), No. 1, pp. 67–106*).—This section of this report contains the results of special analyses of 187 samples and official analyses of 175 samples of fertilizers and fertilizer materials offered for sale in Florida during 1922. The official analyses are accompanied by guaranties for each brand.

Commercial fertilizers, 1922 [Maine], J. M. Bartlett (*Maine Sta. Off. Insp. 105 (1922), pp. 45–76*).—This briefly enumerates the chief points of the Maine fertilizer inspection law, and reports guaranties and actual analyses of 393 samples of fertilizers and fertilizer materials collected for inspection in the State during the spring of 1922. It is stated that the fertilizers collected and examined conformed closely to their guaranties in nearly all instances, were practically free from boron, and no other materials injurious to plants were detected. Directions for home mixing of fertilizers are also briefly presented. Analyses of seven samples of limestone collected in 1921 and 1922 are included.

Fertilizer report, J. W. Kellogg (*Penn. Dept. Agr. Bul. 364 (1922), pp. 91*).—The results of the official inspection of commercial fertilizers offered for sale in Pennsylvania from January 1 to July 31, 1921, are presented in this report, including actual analyses, guaranties, and valuations of 1,257 samples of fertilizers and fertilizer materials collected for inspection.

AGRICULTURAL BOTANY.

Biochemistry of plants, F. Czapek (*Biochemie der Pflanzen. Jena: Gustav Fischer, 1922, 3. ed., vol. 1, pp. XIX+828, figs. 9*).—This is volume 1 of the third edition of this work, which has been noted previously (E. S. R., 45, p. 819).

The physiological anatomy of the plants of the Indian Desert, T. S. Sabnis (*Jour. Indian Bot., 1 (1919), Nos. 2, pp. 83–43, figs. 17; 3, pp. 65–88, figs. 34; 4, pp. 97–113, figs. 17; 1 (1920), Nos. 6–7, pp. 183–205, figs. 37; 8, pp. 237–251, figs. 23; 9–10, pp. 277–295, figs. 35; 2 (1921), Nos. 1–2, pp. 1–19, figs. 39; 3, pp. 61–79, figs. 42; 4–5, pp. 93–115, figs. 46; 6–7, pp. 157–173, figs. 22; 8–9, pp. 217–235, figs. 39; 10, pp. 271–299, figs. 11*).—The favorable year 1917 (rainfall 40 in.) and resulting unusual survival of the plants were utilized to secure accurate figures and clear descriptions of plants on a portion of the Indian Desert, which is mapped and described. Concluding remarks summarize the author's observations and inferences regarding epidermis, stomata, assimilatory tissues, veins, hairy covering, glandular hairs, water storage tissues, secretions, sclerotic modifications of the pericycle, and conducting system.

Rhythmic precipitation phenomena in plant cell membranes, H. P. Müller (*Kolloidchem. Beihefte, 14 (1921), No. 3–5, pp. 97–146, pl. 1, figs. 3*).—A detailed study is described of a zoning effect noted in different sections, chiefly of wheat grains, after they had been kept in silver nitrate solution, also of the relation of this effect to the concentration and diffusion rate of the solution, the temperature, and the assumed colloidal character of the plant cell membranes. Cellulose walls do not here function as semipermeable membranes, though it is assumed that the corky integument layer of the seed coat behaves as a semipermeable layer.

Semipermeability in cell walls, H. Schroeder (*Biol. Zentbl., 42 (1922), No. 4, pp. 172–188*).—This work, continuing studies previously noted (E. S. R., 34, p. 31), with the collaboration of Möller and the aid of data from his work

above noted, gives details regarding phenomena observed in connection with the behavior of semipermeable vegetable membranes, solutions, water, and alcohol.

Cell-division hormones and their relations to wound repair, fertilization, parthenogenesis, and adventive embryogeny, G. HABERLANDT (*Biol. Zentbl., 42 (1922), No. 4, pp. 145–172, figs. 9*).—A report in synthetic detail is given of facts noted and main conclusions obtained in a study during 20 years, employing largely more or less isolated cells (as elementary organisms) from a considerable number of higher plants; wound reaction stimulus as related to cell division with or without washing the surfaces or other treatments; parthenogenesis under manipulation; and adventive embryogeny under conditions described. It is claimed that three kinds of cell division hormones can be shown to exist in the higher (vascular) plants.

Water content of barley kernels during growth and maturation, H. V. HARLAN and M. N. POPE (*Jour. Agr. Research [U. S.], 23 (1923), No. 5, pp. 333–360, figs. 15*).—Previous studies with hulled varieties of barley (E. S. R., 45, p. 128) showed that at flowering time the average water content of the ovaries is about 80 per cent, and the percentage of water in the growing kernel decreases uniformly day by day until the average for all the kernels of a spike is about 42 per cent, when the deposit of dry matter is interrupted and the kernels dry with great rapidity. Subsequent studies with two varieties of naked barley confirmed the previous conclusions regarding the water content of the individual grain in relation to its stage of maturity. The endosperm cells are said to mature abruptly, the proteid content probably reaching a density beyond which it can not function. In the variety Jet, which is a naked barley in which a black pigment is formed in the pericarp, the appearance of color begins on the dorsal surface near the tip. The region of the embryo on the dorsal surface becomes colored still later, and the cells adjacent to the furrow are the last to mature. The first cells on the dorsal surface were found to be affected when the moisture content of the kernel had fallen to from 60 to 62 per cent.

It is claimed that the date of final maturation can be postponed and the size of the kernel increased where kernels are protected by leaf sheaths or other shade, and by cool weather during the period of ripening.

The erectness of plants, J. SMALL (*Belfast Nat. Hist. and Phil. Soc., Proc., 1920–21, pp. 91–106, pls. 3, figs. 3*).—The hypothetical mechanism involved in the hydrion differentiation theory of geotropism is discussed in some detail, as conceived and tested by the author in connection with facts and views set forth in expositions of previous work more or less related to the group of facts now presented (E. S. R., 46, p. 527).

Proteins are very slightly acidic; a medium may with slight differences or alterations be or become, relatively to contained proteins, either acid or alkaline. The cytoplasm of the plant cell contains protein particles, which are lighter than the rest of the fluid. If large enough (0.0002 to 0.0008 mm. in radius) they will under gravity cream upward, just as fat globules cream upward in milk. As calculated, the rate of such movement would be about 0.002 to 0.028 mm. in 7 minutes, the time required in case of a bean root for gravity to develop its proper effect. The positive charges which these carry develop an electrical current which proceeds downward along the fine protoplasmic threads which constitute with the cells a battery connected in parallel and in series. This battery, when the root is placed horizontally, gives a recognizable electrical current downward and along the cortex of the underside of the root, thence around the root and back along the upper side. On account of leakage the current is stronger on the under than on the upper side of the root. The resulting increase in permeability and corresponding decrease in

turgor and growth rate, greater on the underside of the root, eventuate in a curving downward of the rootlet.

In the stem, the protein particles carry an electronegative charge, the rest of the cytoplasm being relatively alkaline. The creaming upward of these negatively charged protein particles develops a negative charge and eventuates in an upward curvature for the young shoot (growing point).

With this theory as a working hypothesis, tests were made on seedlings of bean and maize. In an alkaline medium the tips of the rootlets turned slightly upward. In an acid medium the stems turned downward. Recovery of normal tropism occurred under normal conditions.

Carbon dioxid accumulation in the (closed) root (apex), its transmission through passages to the stem and leaves, and its escape or utilization there with resulting relative alkalinization of that region were strongly suggested as the explanation of the essential differentiation between root and stem, at least as regards geotropism. This view was supported by the results of testing experiments, as well as by recovery of normal behavior under normal conditions. The growth in other positions is also discussed, as is the origination and growth of leaves.

The outstanding practical application of these facts and theories occurs in the earthing up of potatoes, which has been found to increase crop returns.

Significance of the behavior of sensitive stigmas, F. C. Newcombe (*Amer. Jour. Bot., 9 (1922), No. 3, pp. 99–120*).—In all, 25 species and varieties of plants in four families have been reported with sensitive stigmas, four of them for the first time in the present paper. The stigmas are composed of two tongue-shaped lobes of equal or unequal size which diverge from 90° to nearly 360° when ready for pollination. The natural stimulus for the stigmas is the pressure of the body of the visiting insect or other animal, and the response consists in the closing together of the two lobes, so that the lobes, except in the case of Utricularia (in which only the lower lobe receives the pollen as contrasted with others, the receptive region of which for pollen is the inner or opposed surfaces of the two lobes), are in contact over the most or the whole of their inner surfaces. An appreciable pressure is required to produce a response, and pollen may be artificially applied to the stigmas without causing them to close. The stigmas will also respond to an electric current, perhaps to vapors in some species, and the stigmas of *Catalpa bignonioides* and *Mimulus glabratus jamesii* respond to crushing or pinching of the style. The conduction of a stimulus from one stigma lobe to another has been determined positively for only the three species *Martynia lutea*, *M. proboscidea*, and *Mimulus cardinalis*.

The present study has shown that the phenomenon of stigmas opening soon after pollination is more general than hitherto supposed. The stigmas of *U. vulgaris* and *M. glabratus* always open after pollination, those of *Torenia fournieri* and *C. bignonioides* sometimes open in not very dry air, and half of them, or more, will open in moist weather. After the primary closing at the time of pollination, the stigmas that open close again 2 to 10 hours after the opening, unless the air is very moist.

A list is given of plants reported as having sensitive stigmas.

Undercooling of peach buds, E. S. Johnston (*Amer. Jour. Bot., 9 (1922), No. 3, pp. 93–98, fig. 1*).—By means of a thermoelectrical method the extent of undercooling of Elberta and Greensboro fruit buds exposed to the low temperatures of freezing mixtures was determined. The data indicate an increase in the tenderness of these buds with the approach of spring. Just before the petals opened, the buds of the Greensboro variety withstood a greater undercooling than did those of the Elberta. Other data indicate

that wet buds freeze at a higher temperature than dry buds. Cold weather immediately following a rain is thus apparently more dangerous to peach fruit buds than cold weather alone.

Use of alternating temperatures in the germination of seeds, G. T. HARRINGTON (*Jour. Agr. Research [U. S.], 23 (1923), No. 5, pp. 295–332, figs. 20*).—The results are given of extensive investigations on the effect of alternating temperatures on the germination of various seeds. The seeds of carrot, parsley, timothy, awnless brome grass, perennial and Italian rye grasses, meadow fescue, and several kinds of flower seeds were found to germinate practically as well at favorable constant temperatures as at alternate temperatures. Seeds of redtop, parsnip, and sometimes seeds of petunia germinate somewhat better, and seeds of celery, orchard grass, Kentucky blue grass, Bermuda grass, and Johnson grass germinate much better with favorable alternations of temperatures than at constant temperatures.

The exact alternation of temperatures giving the best results is said to depend upon the kind of seed and to some extent upon its physiological condition.

The range of temperature found to give maximum germinations to various kinds of seeds is shown.

Germination-inhibiting substances and false germination, W. MAGNUS (*Ber. Deut. Bot. Gesell., 38 (1920), Gen. Versamml. Heft, pp. 19–26*).—Recent studies with *Phacelia tanacetifolia* are outlined in which seeds were tested as to any effect of washing and of illumination on the time and percentage of germination. Both were effective, as was also removal with a sharp razor of a very thin layer from the surface region of the chalaza. Details are given of tests regarding other factors supposedly influencing germination, also of tests producing what is called false (apparent) germination.

The distribution of manganese in higher plants, G. BERTRAND and M. ROSENBLATT (*Ann. Inst. Pasteur, 36 (1922), No. 3, pp. 230–232*).—The results of analysis applied to numerous parts of *Nicotiana rustica* and *Lilium lancefolium rubrum* are held to confirm the authors' view that alleged exceptions to the presence of manganese reported by others were due simply to the employment of methods which were either not adapted to the purpose or insufficiently sensitive.

Studies upon the life cycles of the bacteria.—II, Life history of Azotobacter, F. LÖHNIS and N. R. SMITH (*Jour. Agr. Research [U. S.], 23 (1923), No. 6, pp. 401–432, pls. 9*).—In a previous communication (E. S. R., 35, p. 728) the life history of Azotobacter and bacteria in general was shown to be much more complicated than had previously been assumed. In the present contribution the authors give the results of the studies of a large number of cultures of Azotobacter which represented 30 strains. The vegetative and reproductive cells were found to be fundamentally the same with all the strains, while the cultural peculiarities allowed a separation of the four species *A. chroococcum*, *A. beijerinckii*, *A. agile*, and *A. vitreum*.

It is claimed that only two species of Azotobacter have been completely characterized, namely, *A. chroococcum* and *A. agile*. The relation of a large number of other species to these is discussed. It is also claimed that the different developmental stages of Azotobacter were observed, some of which could be identified with certain species belonging to the form genera, and this is said to indicate the necessity for a complete revision of the system of bacteria based upon thorough examinations of their life histories.

The cause of sterility in some Prunaceae, K. E. BECKER (*Untersuchungen über die Ursache der Sterilität bei einigen Prunaceen. Inaug. Diss., Ver.*

Friedrichs-Univ., Halle-Wittenberg, 1920, pp. 44, pl. 1).—Study is recorded of cases showing sparse or no fructification in a number of species and varieties of Prunus. Structural or developmental defects are indicated.

Conjugation conditions and secondary sex characters in Ustilago violacea, R. BAUCH (*Biol. Zentbl., 42 (1922), No. 1, pp. 9–38*).—In *U. violacea* conjugation depends primarily upon the acid content, secondarily upon the alkaline content of the medium, and not at all upon illumination. A temperature optimum is clearly distinguishable. Secondary sex characters are outlined.

[The influence of the ages of parents on the dominance of characters in progeny], H. KAPPERT (*Biol. Zentbl., 42 (1922), No. 5, pp. 223–231*).—Testing the view, supported by Zederbauer (E. S. R., 30, p. 739), that in a plant resulting from a crossing the dominance of a character is dependent partly upon the age of one or both of the parent plants when crossed, the author carried out experimentation with peas and tabulates herein the results, giving his explanation of the contradiction between these results and those of Zederbauer.

Injury to plants near electrochemical works, H. FAES (*Les Dommages Causés aux Cultures par les Usines d'Electro-chimie. Lausanne and Paris: Libr. Payot & Co., 1921, pp. 107, figs. 13*).—Recent development (especially since the outbreak of the World War) in the employment of electrochemical processes has entailed considerable injury (sometimes involving much financial loss) to growing plants in the neighborhood of the works, especially in the direction of the prevailing air movements.

The visible effect as here noted is characterized not by scorching but by the deposit of the materials on the surface and the lowering of the product. The injury appears to be due less to the deposit (screening off the solar energy or checking stomatal functioning) than to the effects of toxic soluble substances taken in from the air. Among these are named cyanamid, soot containing tar derivatives, and traces of mineral acids.

FIELD CROPS.

Report from Holly Springs Branch Experiment Station for 1922, C. T. AMES (*Mississippi Sta. Bul. 211 (1922), pp. 16, figs. 3*).—The progress (E. S. R., 47, p. 428) of varietal, fertilizer, and spacing trials with cotton and sweet potatoes, and a comparison of corn varieties are reported, together with suggestions for the culture of these crops and of soy beans. The varieties, spacings, and fertilizer applications recommended for cotton production on hill and valley land are in harmony with earlier conclusions and recommendations. The adaptation of the section for dairying is pointed out briefly.

Report of the [field crops] work at the Raymond Branch Experiment Station, C. B. ANDERS (*Mississippi Sta. Bul. 213 (1923), pp. 3–7*).—The results of varietal and fertilizer trials with cotton and varietal tests with corn are tabulated for the years 1921 and 1922. The best yields and increases with cotton were obtained from 5 tons of stable manure with 200 lbs. of acid phosphate. Differences in yields of cotton were not observed in a comparison of regular cultivation v. cultivating middles alternately.

[Report of field crops work in Pennsylvania] (*Pennsylvania Sta. Bul. 176 (1922), pp. 7–9*).—Applications of lime sufficient to meet the lime requirement gave 6.7 bu. more of corn than 1,000 lbs. of lime. Two 500-lb. applications on wheat and corn, in a rotation of corn, oats, wheat, and grass, averaged 3.3 bu. more of corn than the same amount of lime applied once to wheat in a rotation. Burnt lime, hydrated lime, and pulverized limestone applied in equivalent amounts of active material produced practically the same yields of corn.

The leading varieties of wheat, oats, and barley are indicated as heretofore (E. S. R., 47, p. 429). In a comparison of different spring grains, Japan oats produced 1,952 lbs. of grain per acre; Charlottetown barley, 1,541 lbs.; spring emmer, 1,284 lbs.; and Blue Ribbon spring wheat, 780 lbs. Elton soy beans made a 9-year acre average of 21 bu. and are recommended for seed or hay production. Soy beans grown with corn for silage did not give increased yields of material, and did not affect appreciably the protein content of the silage.

Baltic, Cossack, Grimm, and California-grown common alfalfa have averaged about 1,000, 800, 600, and 500 lbs. per year, respectively, better than the check strain of common alfalfa.

In a test of mixtures of different grasses and clovers for permanent pasture, seeded in 1912, Kentucky blue grass and redtop, along with adventitious Canadian blue grass, have been the most persistent of the grasses; timothy, brome, and orchard grass still persist to some extent; and meadow fescue persists the least. Red clover and alsike were abundant for only two years, white clover still persists and has spread to some extent, whereas little Ladino clover is to be found at present. The best timothy selection has averaged 1,090 lbs. more hay per acre than commercial timothy.

[**Field crops work in Washington**], W. I. Nightingale, E. G. Schafer, O. M. Morris, M. A. McCall, R. P. Bean, and C. E. Hill (*Washington Col. Sta. Bul. 175 (1922), pp. 14, 25, 26, 32, 33, 46, 47, 51, 52, 60, 61*).—The progress of earlier work with field crops (E. S. R., 47, p. 528) is reported.

Observations on the effect of sunlight on the longevity of *B. radicicola* applied to seeds of four varieties of legumes indicate that while all the bacteria are not killed immediately by exposure to sunlight, a very high percentage is destroyed during the first few days. From then on appreciable numbers have been found alive on the seed after four months' exposure to sunlight.

Tests of more than 2,000 rows of varieties and hybrids of wheat for smut resistance pointed out that most wheats are susceptible to smut, often producing less than 10 per cent of normal heads under conditions favoring infection, and many are intermediate, producing from 20 to 80 per cent of normal heads under such conditions. Smutproof, Martin Amber, Red Hussar, and White Odessa are said to be entirely immune to smut. Smut resistance is stated to be heritable but induced by multiple factors in Marquis×Turkey, Triplet×Turkey, Hybrid 128×Turkey, Fortyfold×Turkey, and Turkey×Florence. Wheat smut was found attacking rye and rye-wheat hybrids (E. S. R., 48, p. 334).

An analysis of F_2 hybrids between Turkey and Jenkin wheat indicates that the horny endosperm of Turkey is transmitted as a unit character, the segregation taking place in the heads of the F_1 plants.

Sunflowers in 3.5-ft. rows gave greater yields of both silage and seed than in closer rows, with practically no differences in yield whether plants were spaced 1, 1.5, or 2 ft. apart. Sunflowers have far outyielded corn for silage in the section of the State near the station.

Locality in which grown, freedom from disease, cultural care, and selection of stock and storage of seed material are noted as common factors involved in the production of good seed potatoes.

Preliminary studies at the Adams Substation gave evidence that photoperiodism (E. S. R., 48, p. 27) controls the various stages of development in the wheat plant, and that this factor largely determines differences between winter and spring wheats or between varieties in either group. Seed treatment was not found necessary to prevent smut infection in Turkey (Washington 326) winter wheat seeded in the drier localities.

Alfalfa cut just before blooming, one-half in bloom, and three-fourths to full bloom, has averaged 6.7, 7.8, and 8.1 tons per acre, respectively, at the Irrigation Substation. The leading varieties of alfalfa, winter and spring wheat and barley, oats, field peas, and corn are set forth, with their acre yields.

Varietal trials at the Waterville Substation have not revealed any winter wheat varieties to replace Turkey for grain and Jones Fife for hay. Comparisons of early and late preparation of summer fallow for winter wheat showed the value of early tillage in the spring. The grain and hay yields from tillage experiments, including time of and depth of plowing, tillage before plowing, and packing after plowing for winter-wheat production, are tabulated without comment. Winter wheat harrowed in early spring has averaged 23.3 bu. per acre, medium early spring 24.7 bu., and late spring 26.4 bu., as compared with 27.1 bu. on unharrowed land.

Electroculture (*Jour. Min. Agr.* [*Gt. Brit.*], *29* (*1922*), *No. 9, pp. 792–796; also in Agr. Jour. India, 18* (*1923*), *No. 2, pp. 167–172*).—The data from field experiments at Lincluden, Rothamsted, and Harper Adams College, where spring-seeded oats and barley, winter wheat, and clover hay were subjected to overhead discharges, show that of 14 positive results during 6 years only 3 are lesss than 10 per cent, while none of the 4 negative results reaches this percentage. The average increase of 22 per cent observed with the spring crops indicates that the effect of electrification in increasing the yield of spring-seeded oats and barley has been demonstrated. A beneficial effect on clover hay is thought probable, while that on winter-sown wheat is still uncertain.

Results in pot experiments at Rothamsted with wheat, corn, and barley indicate that alternating current is usually as effective as or more effective than direct current. They suggest that upward current through the plant can increase growth in the same manner as a downward current, and that a discharge applied for the first month only of the growing season may be at least as effective as one continued throughout the growing season.

Effect of burning on vegetation in Kansas pastures, R. L. Hensel (*Jour. Agr. Research* [*U. S.*], *23* (*1923*), *No. 8, pp. 631–644, pls. 2, figs. 4*).—The effect of burning of pastures on the grasses, weeds, yields, and on soil temperatures during the early growing season was studied at the Kansas Experiment Station. Quadrat chartings, between burning (latter March-early April) and July 1, disclosed considerably more grass growth on the burned than on the unburned areas. Differences were not so great at the second charting and were slight at the third, showing that with the advance of the season the vegetation on unburned plats tended to overtake that on burned areas. The average yield from cuttings about September 10 was slightly greater on the unburned area.

Burning did not reduce the total number of grass plants, since at the end of four years 21 per cent more squares containing grass plants were found on the burned area than when the experiment started, and an increase of only 7 per cent in the unburned plat. The number of sedges tended to decrease on the burned area and to increase on the unburned plat. Burning caused a change in the composition of the grass type on the experimental area. Big bluestem (*Andropogon furcatus*) decreased on the burned plat and increased decidedly on the unburned plat, whereas a reverse behavior was noted with little bluestem (*A. scoparius*). Kentucky blue grass increased much more rapidly on the unburned area. Side oats grama decreased on both burned and unburned plats.

Both areas were practically free of weeds when the experiments were started, and a year later a great many were found on both burned and unburned plats.

From then on a decrease was seen each year in the number of weeds on the burned plat, with increased numbers on the unburned section.

Mean maximum soil temperatures at a depth of 1 in. averaged 12.1° F. higher, and the mean minimum temperatures were 4.1° higher on the burned plat, and at a 3-in. depth 3.6 and 4.2° higher, respectively, suggesting an explanation why growth starts earlier when the old vegetation has been removed by burning.

Seeding alfalfa at different rates, H. WITTE (*Sveriges Utsädesför. Tidskr., 32 (1922), No. 6, pp. 307–311*).—This article briefly reviews the results of experiments along this line by a number of investigators in different countries, and it reports the data secured in a test comparing quantities of seed per hectare ranging from 10 to 40 kg. (8.9 to 35.6 lbs. per acre.), with a common difference of 5 kg. The yields of green forage of 3 cuttings during each of 2 years, given in a table, show that the heaviest yields were secured from the use of from 20 to 40 kg. of seed, and that from 20 to 25 kg. of seed per hectare is generally adequate to obtain a satisfactory stand. As compared with 10 kg. the use of 40 kg., a quantity 300 per cent greater, increased the yield of green forage by only 22 per cent, and similarly as compared with 15 kg. the increase in yield was only 6 per cent. Owing to the stooling of the plants the use of 10 and of 15 kg. of seed per hectare reduced the yields least during the second year.

The inheritance of some characters in corn, V. MANDEKIĆ (*Ztschr. Pflanzenzücht., 9 (1923), No. 1, pp. 23–34, figs. 8*).—Comparisons of the progenies from different selections of Croatian Round corn showed length of ear to be inherited, conforming well with Galton's law. Correlation was observed in the material studied between number of rows and length of ear and circumference of ear, yield and length of ear and number of rows, length of ear and circumference and number of rows, circumferences of ear and of cob, and number of rows and circumferences of ear and of cob.

Productive seed corn, T. A. KIESSELBACH (*Nebraska Sta. Bul. 188 (1923), pp. 3–35, figs. 7*).—The problems involved in the production and improvement of seed corn as summarized in this bulletin have been noted in detail from other sources (E. S. R., 39, p. 829; 43, p. 827; 45, p. 230; 48, p. 131).

Cotton experiments, 1922, Delta Branch Station, W. E. AYRES (*Mississippi Sta. Bul. 215 (1923), pp. 14, fig. 1*).—The experiments reported included varietal and cultural trials, breeding work (E. S. R., 48, p. 228), and comparisons of nitrogenous fertilizers (E. S. R., 47, p. 734) with cotton.

Delfos continued to lead Express, Webber, Lone Star, and Cleveland in the order named in total value of seed and lint per acre during five years. Delfos 6102 led 20 varieties and strains in acre value in tests in 1922 in different parts of the Delta, and was outyielded only by Cleveland 54. Delfos 6102, Cleveland 54, and Half-and-Half ranked as given in the test of standard varieties, while Lone Star strains, Delfos 6102, and Mississippi Station Trice led in comparisons of new and miscellaneous cottons. Varieties are indicated for specific soil types on the basis of cooperative tests in Bolivar County, and the results of tests in Washington County by H. B. Brown are tabulated. Prominent Delta-Station-bred strains of Express, Sunpress, and Delfos are described.

At such rates as to add 15 lbs. of nitrogen per acre, ammonium sulphate has given an average increase of 18.3 per cent of seed cotton, cottonseed meal and sodium nitrate 15.3, sodium nitrate 15, cottonseed meal 14.7, ammonium nitrate 13.1, and calcium cyanamid 2 per cent. Different rates of applying sodium nitrate were accompanied by average increases of from 8.4 per cent with 50 lbs. of the salt per acre to 32.8 per cent with 250 lbs. It is felt that the application of sodium nitrate should start soon after chopping and be completed by the beginning of square formation.

Eight-in. spacing continued to give the best average returns, with 12 in. next in productivity among the practical methods. Webber cotton thinned early produced 32.4 per cent more seed cotton than late thinned, an excess of 89 per cent being noted at the first picking. Topping reduced the yield of Express in both 1921 and 1922.

Cotton spacing, H. B. BROWN (*Mississippi Sta. Bul. 212 (1923), pp. 16*).—A survey of the results in 64 pre-boll weevil spacing experiments at the station and elsewhere show that 12-in. spacing in 3.5- to 4-ft. rows yielded highest in 24 tests. The closer spacing generally gave better yields on the less fertile land, whereas wide spacing produced highest on rich lands in a number of cases.

In 11 tests conducted in the State under boll weevil infestation, 9 gave the best yields with a spacing of 12 in. or closer. The width of rows should be that most convenient for cultivation, with the number of plants per acre regulated by the spacing in the drill. It is felt that on poor land, both with boll weevil and without, cotton plants should be spaced closely, 2 to 4 plants per hill, with hills 10 to 12 in. apart in 3-ft. rows. Two stalks per hill with hills 12 in. apart in 3.5-ft. rows is suggested as a minimum distance on medium rich to rich soils, with or without weevil. Closer spacing is indicated as conducive to early maturity, or at least to earlier opening of bolls. For distances that are practicable for cultivation, 12 in. or more, two plants per hill will apparently give better yields than one. Checked rows are probably economical where labor is scarce or on land very foul with nut grass or other weeds.

The apparent lack of evidence of increased yields due to delayed thinning, and data from 3 stations showing that late thinning often results in lower yields, make it seem to the author that the single-stalk method of cotton culture (E. S. R., 39, p. 534) is of doubtful value. It is believed that cotton plants should be thinned as soon as the danger of losing a stand from cold weather, damping-off, etc., has passed, and before the plants are stunted by undue crowding.

Self-fertilization and cross-fertilization in Pima cotton, T. H. KEARNEY (*U. S. Dept. Agr. Bul. 1134 (1923), pp. 68, pls. 7, figs. 4*).—Experiments carried on with the Pima variety of Egyptian cotton, largely at Sacaton, Ariz., are described, together with comparisons with upland cotton. Investigations of the structure and later ontogeny of the flower, of the deposition of self and of foreign pollen upon the stigmas, and of the competition of like and unlike pollens are reported to aid in explaining the predominance of self-fertilization.

The data indicate that although the cotton flower is well adapted to cross-pollination most of the ovules are usually self-fertilized. The percentage of vicinists or natural hybrids produced when two distinct varieties or types are grown side by side is not large ordinarily, although a small initial percentage may seriously impair the purity of the stock. In the Egyptian type of cotton, particularly, self-fertilization has been found to predominate to a considerable extent over cross-fertilization.

Experimental evidence showed that cross-fertilization in the Pima cotton does not occur when the extrastaminal portion of the stigmas is excised, while the entire length of the stigmas in upland cottons is accessible to foreign pollen, and excision did not prevent cross-fertilization. The corolla of Pima cotton begins to open about an hour after sunrise and expands during the next four hours, attaining the maximum aperture usually about 10.30 a. m. In upland cottons an aperture appears at about the same time as in Pima, but the subsequent expansion is more rapid. The opening of the anthers and release of pollen in Pima cotton precedes the expansion of the corolla, whereas in upland cottons, as a rule, corolla and anthers commence to open almost simultaneously.

The habits of the pollinating insects and the relative rates of opening of the corolla and anthers in the two kinds of cotton seem to account for the greater frequency of upland×Pima than of Pima×upland vicinists.

The viability of the pollen of Pima and of Durango upland cotton is low during the early morning hours, begins to increase rapidly between 8 and 9 a. m., and shows a gradual decline after midday. Bagging the flower greatly prolongs the period of viability. Pollen extracted from the anthers and applied to the stigmas the evening before anthesis had a very limited fertilizing ability, while the viability of pollen taken from bagged flowers 26 hours after the beginning of anthesis was still considerable, although greatly inferior to fresh pollen. The stigmas apparently do not remain receptive much longer than 24 hours even when the flowers are protected by inclosure in bags. The limitation of pollen deposition to the lower half of the stigmas and not the environment created by the inclosure of the flower is doubtless responsible for the relatively poor fertilization of bagged flowers. Neither the locus of pollen deposition nor the time of arrival of the pollen seem to be important factors in the preponderance of self-fertilization in Pima cotton. Preponderance of self-pollination would seem to be an important, if not the principal, factor in the preponderance of self-fertilization.

Insect pollination of cotton at Sacaton, Ariz., is effected principally by Hymenoptera, the honeybee and wild bees of the genus Melissodes being the most important species. Certain Coleoptera and Hemiptera also have been observed to carry pollen, but these insects probably are insignificant as pollinators. In localities where bees are not numerous in the cotton fields (E. S. R., 46, p. 31) comparatively little pollen reaches the upper part of the stigmas of Pima flowers, and here artificial pollination resulted in a marked increase in fertilization, whereas where the cotton flowers are much frequented by bees artificial pollination did not affect the degree of fertilization.

No consistent differences in the degree of fertilization were attained within the Egyptian type, whether the stigmas received self pollen, pollen from other plants of the Pima variety, or pollen of another variety of the Egyptian type. On the other hand, somewhat better fertilization of the Pima flowers was obtained in several cases with pollen of an upland cotton than with pollen of the same variety. Pollinating some Pima flowers with Pima and others with upland pollen gave no satisfactory indications of a difference in the relative growth rate of the pollen tubes of the two types.

Selective fertilization, in favor of the related pollen, was noted when pollen of the same variety was in competition with pollen of another Egyptian variety or with pollen of upland cotton on the stigmas of Egyptian cottons. However, the results obtained by A. McLachlan[1] indicated the absence of a corresponding prepotency of upland pollen on upland stigmas. The degree to which selective fertilization contributes to the greater frequency of self-fertilization remains doubtful. In order to explain the fact of selective fertilization when the two pollens are in direct competition, it seems necessary to assume an inhibiting influence of pollen of the same variety upon the more foreign pollen. The degree of fertilization resulting from natural pollination has been found to differ in different seasons and at different times in the same season, as well as at different localities.

Proportions of boll shedding in Pima cotton ranging from 3 to 25 per cent have been recorded at Sacaton for different years and for different lots of plants. It is considered improbable that deficient pollination and fertilization are primarily responsible for boll shedding at this locality.

The fertility of Pima cotton did not appear to have been impaired by strict inbreeding during five or seven successive generations. Deleterious factors

were probably eliminated in the ancestry of the Pima variety, and its present state of fertility seems to be due to segregation rather than to heterosis.

Methods of examination of certain characters in cotton, G. R. HILSON (*Agr. Research Inst., Pusa, Bul. 138 (1922), pp. 28, pls. 2*).—The characters dealt with are lint length, weight of seed, and weight of lint per seed of cotton produced in southern India.

The method of determining lint length found best was that of Balls (E. S. R., 35, p. 230), which consists of combing out the lint on the seed and measuring the maximum length from the seed to the edge of the halo along a radius. The seed at the apex and base of a lock did not vary definitely from the seed in the middle, whereas different locks from the same or different bolls varied considerably. The studies indicate that combed length of lint can be accurately measured to 1 mm., and that all the lint need not be combed out. The average combed length closely approximates to the average single fiber length, differing about 1 mm. The range of variation of combed length indicates the range of variation of single fiber length. One hundred seeds from about 100 different locks seem to be a sufficient number on which to determine average seed weight and weight of lint per seed, giving a probable error of 1.3 per cent for seed and 1.4 per cent for lint. For all ordinary purposes, the error due to fluctuations in humidity may be ignored, provided weighings are limited to dry weather and are not made on days of excessive humidity.

Cotton production in Missouri, W. C. ETHERIDGE and C. A. HELM (*Missouri Agr. Col. Ext. Circ. 122 (1923), pp. 20*).—Practical suggestions given for the growing of cotton in Missouri indicate the producing region, compare cotton farming with diversified farming, and describe varieties, cultural methods and field practices, rotations, harvesting and marketing practices, and important insects and diseases. Varietal and fertilizer tests with the crop have been noted (E. S. R., 48, p. 628).

Cotton production and distribution, season of 1921–22 ([*U. S.*] *Bur. of the Census Bul. 150 (1923), pp. 128, figs. 19*).—Statistics similar to those noted earlier (E. S. R., 46, p. 635) are tabulated for the season of 1921–22.

The selection of flax, L. BLARINGHEM (*Rev. Bot. Appl. et Agr. Colon., 3 (1923), No. 17, pp. 3–25, figs. 3*).—Morphological characters used to differentiate and control pure lines are considered. Comparison of a number of pure strains demonstrated the practicability of maintaining the purity of a flax line when planted with numerous other lines. Pods with nonciliated septa and with green seed were found to be recessive to those with ciliated septa and brown seed. Although variations due to cross-pollination by insects were not apparent in the progeny, security against such is not considered absolute.

Flax selections and varieties in 1922, H. KAPPERT (*Faserforschung, 3 (1923), No. 1, pp. 1–11*).—White-Blossom Dutch and a Davis strain (E. S. R., 48, p. 32) were outstanding in comparisons of flax selections and varieties at Sorau. Late varieties yielded better than earlier sorts.

Hemp breeding in Hungary, G. HAVAS (*Ztschr. Pflanzenzücht., 8 (1922), No. 4, pp. 425, 426*).—A summarized account of the work of R. Fleischmann in increasing the stalk and fiber yield of Italian and Provençal hemp per unit area and improving the quality of the fiber.

The small-seeded horse bean, Vicia faba minor, P. B. KENNEDY (*California Sta. Circ. 257 (1923), pp. 23, pl. 1, figs. 14*).—The characteristics, cutlural needs and uses of the small-seeded horse bean are described, together with the results of experiments with the crop at the station.

Davis farm was not found to be well suited to growing the crop without fall irrigation, and the yields were much lower than on the coast, where more

rainfall and milder winter conditions obtain. The size of the seed has not been found to influence the size of the plants, the smaller seeds having a tendency to produce plants with a greater number of stems. The aim of current experiments is to select a small seed so that the seeding requirement will be considerably reduced.

Analyses show that the percentage of moisture is greatest when the plants are in bloom, decreasing as they reach maturity. About 0.5 lb. of nitrogen is contained in every 100 lbs. of tops for green manure. Another test demonstrated the feasibility of making silage of excellent quality from red oat hay and horse beans. Such silage was shown to be higher in protein than either Indian corn or sweet sorghum and with nearly twice the fat content.

The second generation of tubers in potatoes, S. I. NEBOLSIN (*Trudy Moskov. Oblastn. Selsk. Khoz. Opytn. Sta.* (*Works Moscow Regional Agr. Expt. Sta.*) *Bul. 1 (1922), pp. 112, 113, 126*).—Alternate dry and wet periods are said to have caused young tubers to sprout, resulting in the appearance of three generations in the summer of 1920. Seed tubers from the first two generations produced well-developed plants when planted the following year. Accompanying the decrease in size of seed tuber were decreases in the total crop and number of tubers and increases in the average weight of tubers harvested.

Potato growing in Australia, G. SEYMOUR (*Melbourne: Whitcombe & Tombs, Ltd., pp. 124, pls. 15, figs. 17*).—Practical suggestions are offered for the production of potatoes under varying conditions in Australia, with notes on diseases, insects, and breeding practices.

Spraying Irish potatoes, J. T. ROSA, JR. (*Missouri Sta. Bul. 198 (1923), pp. 8, figs. 2*).—The desirability of spraying potatoes with Bordeaux mixture, as well as with an arsenical to kill insects, is shown, and directions are suggested for growing and spraying the crop.

Results of spraying experiments in 1921 indicate that Bordeaux mixture with lead arsenate is more effective than Bordeaux mixture alone, even when biting insects are absent. The addition of nicotin sulphate to the spray material is apparently unnecessary. Very marked increases in yield occurred on plats of Early Ohio potatoes sprayed with Bordeaux mixture alone and in different combinations. In 1922 the increase in yield due to spraying was even greater in the Irish Cobbler variety than in the Early Ohio.

Most of the tubers from the Bordeaux-sprayed plats of Early Ohio were misshapen as a result of second growth, or bearing knobby protuberances. The Irish Cobbler tubers, however, in the sprayed plats were practically free from second growth and were neither misshapen nor knobby to any great extent. Spraying of the Early Ohio variety with Bordeau mixture does not seem likely to pay, in spite of the increased yield, because of this objectionable tendency of the tubers. The increased yield of tubers obtained in these spraying experiments is thought due almost entirely to tuber growth made by the sprayed plants after the unsprayed plants have begun to die.

Observations on some rice weeds in California, P. B. KENNEDY (*California Sta. Bul. 356 (1923), pp. 465–494, figs. 26*).—Weeds infesting rice fields in California are described and, where known, control methods (E. S. R., 49, p. 34) are indicated. Those giving the greatest present trouble in rice culture and irrigation or considered as with potential menace include *Echinochloa crusgalli*, joint grass (*Paspalum distichum*), *Phalaris* spp., rice cut grass (*Leersia oryzoides*), beard grass (*Polypogon monspeliensis, P. littoralis*), red rice (*Oryza rufipogon*), salt grass (*Distichlis spicata*), "nut grasses" (*Cyperus esculentus, C. rotundus*), spike rush (*Eleocharis palustris*), cattail, arrowhead (*Sagittaria latifolia*), water plantain (*Alisma plantago aquatica*), upright

bur-head (*Echinodorus cordifolius*), large-leaved pondweed (*Potamogeton amplifolius*), basket willow (*Salix exigua*), red stem (*Ammania coccinea*), and smartweeds (*Polygonum* spp.).

[Hulled and unhulled sainfoin seed], V. Rivera (*Riv. Biol. 4 (1922), No. 1, pp. 14–22*).—Comparisons of hulled and unhulled seed of sainfoin (*Onobrychis sativa*) in both laboratory and field showed that the pod not only favors dissemination but also affords mechanical protection to the seed, stores moisture, and equalizes the variations in humidity. The studies indicate the greater certainty of meadows sown with unhulled seed.

Soy beans, H. D. Hughes and F. S. Wilkins (*Iowa Sta. Circ. 84 (1923), pp. 15, figs. 7*).—Cultural and field practices are suggested for growing soy beans for seed, for hay, and in corn in Iowa. Manchu is probably the leading variety alone for seed and in corn to hog down, and Peking in corn for silage. Columbia, Peking, Wilson, Morse, and Virginia have averaged highest alone for hay, and these sorts and Midwest are recommended in corn to sheep down.

The soy bean and its vegetable milk, L. Rouest (*Le Soja et Son Lait Végétal. Carcassonne (Aude): Author, 1921, pp. IV+157, figs. 8*).—This work includes a concise historical account of the soy bean in Europe, with discussion of its botanical characteristics, adaptation, cultural needs and problems, varieties, grain yields, forage value, and merits as an oil plant. The production of soy bean milk and the place of the soy bean in the human diet are given detailed treatment.

Sugar cane culture for sirup, I–XIV, P. A. Yoder (*Facts About Sugar, 15 (1922), Nos. 1, pp. 12, 13; 2, pp. 34, 37; 6, pp. 114, 115; 8, p. 158, fig. 1; 9, pp. 176, 177, fig. 1; 11, pp. 222, 223; 13, pp. 260, 261; 15, pp. 302, 303; 16, pp. 322, 328, fig. 1; 17, pp. 337, 341, 343, figs. 3; 19, pp. 380, 381; 20, pp. 402, 403, 405, fig. 1; 23, pp. 462, 463; 26, pp. 518–520*).—The information included appears to be a modification of that noted earlier (E. S. R., 36, p. 835; 40, p. 830).

Factors affecting the stand and yield of sweet clover, H. W. Hulbert (*Jour. Amer. Soc. Agron. 15 (1923), No. 3, pp. 81–87*).—Sweet clover was seeded alone, with nurse crops cut for grain and for hay, and at different rates and dates with wheat as a nurse crop at the Idaho Experiment Station.

Where the sweet clover was grown with a nurse crop a very close correlation existed between stand and yield. When no nurse crop was used the higher yields were obtained from the lower rates of seeding, but the hay obtained from the lighter seedings and from the row seedings was very coarse and stemmy. The average loss in stand where the nurse crop was cut for grain was only slightly higher than where cut for hay. Peas made a more desirable nurse crop than wheat, oats, or barley. No relation was apparent between the water requirement of the nurse crop and its desirability from the standpoint of effect upon the stand and yield of sweet clover obtained.

Sweet clover (*Ontario Dept. Agr. Bul. 296 (1923), pp. 1–4, 7–11*).—Sweet clover has given fair results on the Ontario Agricultural College farm as pasture for dairy cows, as a soil builder, and as silage, but has not been a satisfactory hay crop. In tests with the white-flowered biennial the most successful seedings were in March on bare frozen ground, and in April and May on a well-cultivated seed bed, and a rate of about 20 lbs. per acre produced the most and best hay. Unhulled unscarified seed germinated 23 per cent, hulled unscarified 39, and scarified seed 90 per cent.

Yields from cuttings at different growth stages were as follows: Before bud formation 11.7 tons of green fodder, 1.8 tons of hay; commencing to bud 13.8, 3.4; late bud 15.1, 3.6; one-half bloom 17.8, 5.8; and one-half of seed pods formed 15.9, 6 tons. The best hay was from the late bud cutting.

When green fodder from these stages was ensiled the most satisfactory silage resulted from the commencing to bud and late bud stages, and when no water was added the greatest yield of silage was from the late bud and early bloom stages.

Analyses of the green fodder and silage showed samples of silage from the several growth stages to be very even in moisture content and general composition. They contained nearly twice as much crude protein and about the same amount of crude fat and fiber, but much less soluble carbohydrates, than corn silage.

[Tobacco production in the Southern States] (*Tobacco, 75 (1923), No. 22, pp. 39–46, 50, 51, 57, 58, 61–63, 64–66, 71, 85, 87, 89, 93, 95, 97, figs. 44*).—Among the papers included in this number are the following: Importance of Tobacco Crops Grown in Various Southern States, by D. D. Long; Statistical Facts About Tobacco Production in North Carolina, by W. H. Rhodes, jr.; Tobacco Growing in Western Kentucky and Northern Tennessee, by M. E. Bacon; New Facts About Growing Tobacco Discovered by Experimenting, by F. H. Jeter; A Ratio Between Plant Food Elements Which Must Be Maintained, by E. G. Moss; Introduction of Bright Tobacco into Georgia and Its Progress, by E. C. Westbrook; Early History and the Development of Tobacco Culture in Florida, by W. M. Corry; and The Tobacco Auction System Compared with New Cooperative Plan, by E. J. Davis.

Correlations between various characters of wheat and flour as determined from published data from chemical, milling, and baking tests of a number of American wheats, J. Zinn (*Jour. Agr. Research [U. S.], 23 (1923), No. 7, pp. 529–548*).—This contribution from the Maine Experiment Station has been noted from another source (E. S. R., 48, p. 440).

Effects of preceding crops on spring wheat, W. Pokrowsky (*Zhur. Opytn. Agron. Yugo-Vostoka (Jour. Expt. Landw. Südost. Eur.-Russlands), 1 (1922), No. 1, pp. 32–48*).—Field experiments at the Saratov, Russia, Station gave results indicating that spring wheat reacts very strikingly to the preceding crop. Cultivated crops, especially cucurbits and carrots, greatly increased the wheat yield over that of the continuous wheat culture practiced in the region. The percentage increases of grain amounted to 30.9 after cucurbits, after carrots 24.5, corn 20.9, potatoes 19.3, sunflowers 5.8, and after mangels 4. The quality of the grain did not vary greatly with the preceding crop.

Wheat after fallow was not profitable in comparison with annual cropping, even with the poorest preceding crop. Wheat after cultivated crops outyielded the wheat in the 3-field system wherein rye preceded. Better results were secured after annual grasses, preferably sorghum, than when following fallow, rye, and wheat.

The wheats of Bihar and Orissa, A. and G. L. C. Howard and A. R. Khan (*India Dept. Agr. Mem., Bot. Ser., 12 (1922), No. 1, pp. 20*).—This classification of the wheats of Bihar and Orissa deals with 122 agricultural types of *Triticum vulgare* belonging to 12 botanical varieties, 3 of which varieties, *T. vulgare nigricans*, *T. vulgare indicum*, and *T. vulgare bengalensis*, with blackish glumes and awns, apparently have not been described hitherto. This paper supplements a preliminary classification of the wheats of Bengal (E. S. R., 23, p. 638).

The purpose and work of the Montana Grain Inspection Laboratory, W. O. Whitcomb (*Montana Sta. Circ. 108 (1922), pp. 11*).—The work of the Montana Grain Inspection Laboratory (E. S. R., 48, p. 735) in making milling and baking tests with wheat, grading and inspecting grain, and testing agricultural seeds is outlined, together with regulations pertaining to these activities.

Commercial agricultural seeds, 1922, compiled by W. J. MORSE (*Maine Sta. Off. Insp. 106 (1922), pp. 78–93*).—The purity, germination, and weed seed content of 158 official samples of agricultural seed in 1922 are tabulated.

Report of the [Danish] State seed control in its fiftieth year, 1920–21, K. DORPH-PETERSEN (*Tidsskr. Planteavl, 28 (1922), No. 1, pp. 129–175, figs. 2*).—The activities of the Seed Control Service are reported in detail, the financial statement for the year is presented, and the new building, planned and constructed especially for this service and occupied in July, 1920, is described.

Report on the activities of the German-Swedish seed breeding station at Derenburg in Harz, 1920–22, G. NILSSON-LEISSNER (*Sveriges Utsädesför. Tidskr., 32 (1922), No. 6, pp. 312–325, figs. 2*).—A description of the organization and purpose of this seed growing and plant breeding station is given. The results of variety tests with winter wheat, spring wheat, rye, oats, barley, leguminous crops, root crops, potatoes, rape, and flax in 1921 and 1922 are briefly stated, and compared with earlier results secured by several different agencies in Germany. The station was established mainly for the purpose of determining the value, under conditions prevailing in Germany, of the varieties of field crops originated at Svalöf in Sweden.

Agricultural seed, L. WITTMACK (*Landwirtschaftliche Samenkunde. Berlin: Paul Parey, 1922, pp. VIII+581, figs. 527*).—This is a revised and enlarged edition of an earlier work entitled Gras- und Kleesamen, issued in 1873, giving a comprehensive account of the seed industry in Germany, seed cleaning machinery, seed control stations and their activities, sampling and testing, and including statistics of seed production and commercial movement.

The biology of germination is considered at some length, and the error and values of tests are touched upon. Descriptions, with appropriate keys, are given of the families, subfamilies, tribes, genera, and important species. Seeding tables, regulations for testing seeds, and an extensive bibliography are appended.

HORTICULTURE.

[Horticultural investigations at the Pennsylvania Station] (*Pennsylvania Sta. Bul. 176 (1922), pp. 19–21*).—Brief comments are made upon activities under certain projects. The effect of applying fertilizers in the spring of 1921 to apple orchard areas seeded in timothy and blue grass in 1920 was noted within two weeks in an improvement of the sod and in a better color of the leaves of the trees. The three new tomato varieties, Penn State Earliana, Matchum, and Nittany, mentioned in a previous report (E. S. R., 46, p. 839), were widely distributed during the year, seed being sent to nearly every State in the Union.

[Horticultural investigations at the Washington Station], O. M. MORRIS (*Washington Col. Sta. Bul. 175 (1922), pp. 31, 32*).—A qualitative test of fertilizers in Spokane Valley orchards indicated that no form of commercial fertilizers was of any particular value except when used in orchards the growth of which was unsatisfactory or in which cover crops were being established. The combination of legume cover crops and nitrogen-bearing fertilizers again showed evidence of promoting growth and production (E. S. R., 47, p. 535). Hairy vetch, field peas, and red clover have shown gratifying results. Alfalfa promises well as a cover crop, but is slow to become established. A series of fertilizer and cover crop tests started in five Yakima Valley orchards already indicate that nitrogen-bearing fertilizers favor increased growth and development. Nonnitrogenous fertilizers failed to produce any apparent results.

Time of harvest studies with Jonathan, Stayman, Delicious, King David, and Wagener apples indicated that such factors as color of skin and seeds, size of

fruit, and ease with which it parts from the stem can not be used as safe guides to the stage of maturity.

Report on commercial insecticides and fungicides, 1922 (*Connecticut State Sta. Bul. 242 (1922), pp. 147–165*).—This bulletin is in two parts.

I. *The examination of some materials sold as insecticides and fungicides*, E. M. Bailey and R. E. Andrew (pp. 147–162).—The results of analyses of fertilizers and insecticide materials sold in Connecticut in 1922 are here presented.

II. *Recent developments in the use of insecticides*, W. E. Britton (pp. 163–165).—Emphasis is placed upon the great changes which have occurred in recent years in the kind of materials used in spraying. The use of nicotin sulphate preparations for the control of sucking insects has attained large proportions in a very brief period. It is suggested that the mixing of lime sulphur with lead arsenate and nicotin sulphate may be successfully accomplished if the materials are added in the proper order and if calcium caseinate is used as a spreader.

Insecticides and fungicides, 1922, J. M. Bartlett (*Maine Sta. Off. Insp. 106 (1922), pp. 94–99*).—Following a brief discussion of the requirements of the law regulating the sale of fungicides and insecticides in Maine, the results of analyses of materials received in 1922 are presented.

Analyses of materials sold as insecticides and fungicides during 1922, C. S. Cathcart and R. L. Willis (*New Jersey Stas. Bul. 372 (1922), pp. 5–24*).—In conformity with reports of previous years (E. S. R., 47, p. 140), results are presented of analyses of various insecticides and fungicides sold in New Jersey during 1922.

Spraying and dusting vegetable crops in 1922, F. W. Geise, H. H. Zimmerley, and H. Spencer (*Virginia Truck Sta. Bul. 41 (1922), pp. 237–256, figs. 9*).—This is a further report (E. S. R., 47, p. 236) upon dusting and spraying investigations. Two materials, a dust consisting of 16 per cent dehydrated copper sulphate, 20 per cent calcium arsenate, and 64 per cent finely screened hydrated lime and a spray composed of 4 lbs. copper sulphate, 6 lbs. quick lime, and sufficient water to make 50 gal., with 2 lbs. of calcium arsenate added, were compared as media for controlling insect and fungus pests on the eggplant and tomato.

In the case of the eggplant, the sprayed plats showed a slight superiority in yield for the first and second harvest. However, a summation of yields following the last harvest, August 24, showed 1,080 lbs. for the checks, 2,790 for spray, and 3,257 lbs. for the dust plats. The fungus *Phomopsis vexans*, very abundant during the season and an important factor in cutting yields, was best controlled by the dust. Counts made of flea-beetle punctures showed over twice as many holes on check as on treated plats. Again, in the instance of the tomato, the dusted plats gave the largest yields. The check plants were severely attacked with Septoria leaf-spot, which causes premature defoliation and ripening. As a result, the check plats outyielded the treated plats at the second and third harvest, but were lower in total yield.

In work with cantaloups and cucumbers the Bordeaux mixture was reduced in strength, using 2 instead of 4 lbs. of copper sulphate. All plants, including the checks, were dusted with 3 per cent nicotin soon after the planting in the field. The check cantaloups conspicuously outyielded both the sprayed and dusted. However, the spray and dust checked the spread of downy mildew, prevented defoliation, and assisted materially in maintaining a high quality of fruits. The nicotin application was successful in repelling beetles from the plants. Cucumber yields were as follows: Sprayed plats 791 lbs., dusted 884, and check 786 lbs. of marketable fruits. The sprayed cucumber plants

were apparently more healthy, but their yield was reduced by some unknown influence.

Dependable varieties of vegetables, J. B. KEIL (*Ohio Sta. Mo. Bul., 8 (1923), No. 1–2, pp. 23–25*).—This comprises a list of recommended varieties of vegetables.

[Report of work with tomatoes at the Raymond Substation, 1921 and 1922], C. B. ANDERS (*Mississippi Sta. Bul. 213 (1923), p. 7*).—Records are presented upon the yield and quality of tomatoes produced by 11 varieties in 1921 and 7 varieties in 1922. The largest yield in 1921 was produced by Livingston Manifold and in 1922 by Early Detroit. A test of different fertilizer mixtures for the tomato is reported in tabular form.

The effect of phosphoric acid on maturity in tomatoes, J. R. HEPLER (*Amer. Soc. Hort. Sci. Proc., 19 (1922), pp. 250–255*).—An apparent positive effect of phosphoric acid as a stimulus in promoting the production of early maturing tomato fruits was observed in a study at the New Hampshire Experiment Station, in which Bonny Best plants, growing on a medium loam which had been treated with 3 tons of lime and 20 tons of manure per acre, were fertilized with various amounts and forms of chemical materials.

The largest total weight of fruit for the first two harvests was obtained on the plats receiving 1,000 lbs. of phosphoric acid and 1,000 lbs. of muriate of potash. A summation of the first four pickings shows the phosphoric acid plats very definitely in the lead in respect to yield of fruit. Comparative counts of blossoms and blossom clusters on the various plats on August 1 showed a much larger number of flowers on the phosphorus treated plants, leading the author to believe that phosphoric acid stimulated an early growth which produced a greater number of blossoms and fruits early in the season. Potash not only had little apparent effect on yield but delayed maturity of fruit. The largest average yield was produced on plants receiving a total of 40 tons of manure per acre.

Report on tests of self-sterility and cross-incompatibility in plums, cherries, and apples at the John Innes Horticultural Institution, II, M. B. CRANE (*Jour. Pomol. and Hort. Sci., 3 (1923), No. 2, pp. 67–84, pls. 9, figs. 2*).—Continuing work reported in an earlier paper (E. S. R., 40, p. 148), the author presents the results of an exhaustive study of self- and cross-compatibility in a large number of European plum, cherry, and apple varieties grown in pots in an orchard house.

All of the varieties of sweet cherries tested were found to be self-incompatible. Varying degrees of self-compatibility occurred in the sour cherry groups In reciprocal crosses between varieties in the sweet and sour cherry groups, the larger sets were obtained when the sweet cherries were used as ovule parents. Three groups of sweet cherries have been identified, the members of which are cross-incompatible. However, crosses between varieties within the different groups generally give full crops. Parthenocarpy was recorded in the cherry. Confusion was found in the nomenclature of cherry varieties, e. g., three distinct strains of Black Tartarian have already been discovered.

No evidence was obtained to show that either complete or partial cross-incompatibility exists in the apple. The majority of apple varieties studied proved to be only partially self-compatible. Varieties which refused to set fruit for a period of years with their own pollen suddenly bore a few fruits, indicating that self-incompatibility in the apple is not a strictly constant character.

Crossing studies with plums showed that incompatibility exists to a certain extent in the *Prunus domestica* group. Crosses between *P. domestica* and *P.*

insititia invariably resulted in full crops of fruit. Two groups of plums are listed, the members of which are cross-incompatible.

From a practical viewpoint it is suggested that varieties which flower concurrently should be planted, but for efficient pollination there is no necessity for planting varieties which have no value, nor is it essential to plant a large number of varieties so long as those used have been proved to be cross-compatible.

Data on the lateral spread of the roots of fruit trees, G. S. PEREN (*Jour. Pomol. and Hort. Sci., 3 (1923), No. 2, pp. 96–102, fig. 1*).—Further studies of root development of fruit trees growing at the Long Ashton Research Station, Bristol (E. S. R., 48, p. 736), showed that in the case of healthy, vigorous trees there is considerable overlapping of roots of contiguous trees. This condition, deemed highly detrimental to the welfare of orchards, is especially apt to occur where fillers are grown. Observations on the depth of roots showed that they were for the most part confined to the upper 2 ft. of soil.

Thinning deciduous fruits, W. P. TUFTS (*California Sta. Circ. 258 (1923), pp. 13, figs. 5*).—A circular in which the thinning of fruit is discussed from the practical and physiological viewpoints. Specific recommendations are given for the apple, apricot, and peach, with suggestions for other fruits. A table is presented showing the number of peaches of different sizes required per tree to furnish a given tonnage of fruit per acre of 75 and 108 trees. The author advises that much of the thinning work may be accomplished at the annual dormant pruning by the judicious selection and distribution of fruiting wood.

Water glass, a new wound dressing for trees, W. J. YOUNG (*Ohio Sta. Mo. Bul., 8 (1923), No. 1–2, pp. 13–16, fig. 1*).—Following his work with the grape (E. S. R., 47, p. 344), the author has found that sodium silicate is a satisfactory dressing for tree wounds, the treatment of which is herein briefly discussed.

Experiments with sulphur spray mixtures, A. J. FARLEY (*Amer. Soc. Hort. Sci. Proc., 19 (1922), pp. 220–224*).—Comparative tests conducted by the New Jersey Experiment Stations in the summer of 1922 to determine the value of various summer sprays and dusts for controlling fungus diseases of the peach and apple indicated that the so-called New Jersey dry mix standard spray, composed of 8 lbs. of superfine sulphur, 4 lbs. of hydrated lime, and 8 oz. of calcium caseinate, when properly prepared and applied, is very effective.

Records taken of the percentage of disease-free fruits on peach showed the following results: Check trees 48.6, atomic sulphur spray 55.9, self-boiled lime sulphur 89.5, New Jersey sulphur glue 93.4, sulphur dust 95.1, and New Jersey dry mix standard 96.1. The dust, although a satisfactory fungicide, caused severe defoliation, two-thirds of the leaves having dropped from the trees by September 15. Tests of various materials on apple trees were found inconclusive, in that scab and other fungus diseases were practically absent. In conclusion, the author points out that the New Jersey dry mix standard is equally effective as the old-fashioned self-boiled lime sulphur, and is much safer to use than the diluted commercial product. The mixture is therefore deemed sufficiently worthy to be recommended as a summer spray for all tree fruit diseases ordinarily controlled with lime sulphur.

The relation of soil moisture and nitrates to the effects of sod on apple trees, T. L. LYON, A. J. HEINICKE, and B. D. WILSON (*New York Cornell Sta. Mem. 63 (1923), pp. 5–28, figs. 13*).—In order to determine the underlying causes of the detrimental effect of continuous sod on apple trees, a plantation consisting of 30 plats of 20 McIntosh trees each was established in 1917 under the most uniform conditions possible (E. S. R., 48, p. 536). The plats were planted alternately to rye and timothy, the timothy plats being maintained con-

tinuously throughout the experiment. The rye was planted each year and turned under early in the spring, and on the timothy plats the hay was allowed to lie where it fell at cutting. All plats were fertilized with acid phosphate and muriate of potash. Equal quantities of nitrate of soda were applied to pairs of timothy and cultivated plats in the amounts of 100, 300, and 900 lbs. per acre.

Determinations of moisture and nitrates in the soil made from time to time showed moderate differences in moisture content between the variously treated plats, but these differences were slight as compared with those in nitrate nitrogen. Nitrates were always deficient beneath the sod except where large quantities of nitrate of soda had been recently applied. The disappearance of nitrate nitrogen from the sod plats could not be accounted for by its removal in crops or by its incorporation in roots and stubble, and presumably not by leaching. The authors believe that the smaller amount of nitrate nitrogen in the sod areas may be due to conversion into other compounds. This view was supported by observations on the growth of rye in 1921, following the close of the investigation, in which it was seen that the yield of rye was in the same order as the quantity of nitrate applied the previous year. It is thought possible that the increased rye yields may have been due to nitrification of the nitrogen materials which had been previously converted from nitrate of soda.

In 1920, at the close of the experiment, the average circumference of the trees of the different plats were as follows: Sod without nitrate of soda 8.5 cm., with 100 lbs. nitrate of soda 8.4 cm., with 300 lbs. 9.1 cm., and with 900 lbs. 11.2 cm.; cultivation alone 13.2 cm., cultivation with 100 lbs. nitrate of soda 13.3 cm., with 300 lbs. 13.4 cm., and with 900 lbs. 13.3 cm. Height and width measurements, given in tabular form, show the same general variations. The trees in the cultivated plats did not respond to the addition of nitrate of soda, whereas trees on the sod plats receiving approximately 0.5 lb. of nitrate per tree averaged more than twice the weight of untreated individuals. Trees on sod plats receiving nitrate of soda made vigorous terminal growth, but possessed relatively few branches as compared with those on the cultivated plats. The roots of cultivated trees were more fibrous than those of the sod-grown trees.

Raspberry breeding notes, P. THAYER (*Jour. Heredity, 14 (1923), No. 1, pp. 12, 13, figs. 2*).—Seedling raspberries obtained by fertilizing a wild yellow-fruited form of *Rubus occidentalis* with pollen of Golden Queen were very similar to the ordinary purple-cap, *R. neglectus*, differing only in color of fruit, which was pinkish yellow. The reciprocal cross, Golden Queen×*R. occidentalis*, yielded only a few plants of doubtful characters. Unexpected sterility was observed in seedlings obtained by crossing Cuthbert and Ranere. When Ranere was used as ovule parent only 1 in 7 of the seedlings was sterile, while with Cuthbert as ovule parent 11 in every 24 were fruitless. This result is considered inexplicable in view of the fact that both varieties are presumably of the same species, *R. strigosus*, with perhaps a trace of *R. idaeus* in Cuthbert.

Correlations in the strawberry, M. B. DAVIS (*Amer. Soc. Hort. Sci. Proc., 19 (1922), pp. 260–263*).—Records taken on Parson strawberry plants of known history showed a distinct correlation between the date the stolon plant rooted and the ultimate number of berries it produced. Stolon plants formed as late as October 20 averaged only five berries as compared with 16 for plants formed about the middle of August. Plants formed much earlier than August 15 produced from 9 to 10 berries, a fact which is believed due to their exhaustion from producing stolons of their own. The most profitable period of stolon

formation as correlated with fruit production occurred between the latter part of July and the beginning of September. October stolons, although constituting one-third of the total, produced only 19.6 per cent of the crop. On the other hand, the August stolons, representing but 25 per cent of the total number, produced 34 per cent of the fruit. It was found that stolon plants rooted on October 29, 1921, and transplanted the following spring formed less than an average of one stolon per plant up to July 7, while stolon plants rooted July 23, 1921, and transplanted the next spring formed an average of 2.5 stolons. In conclusion, the author points out that this effect of time of rooting on production may explain apparent correlations in yield of parents and offspring.

Further observations on the fruiting habit of the Concord grape, N. L. PARTRIDGE (*Amer. Soc. Hort. Sci. Proc. 19 (1922), pp. 180–183*).—In extending his experiments of 1921 (E. S. R., 47, p. 344) to include vineyards on light and medium soils, the author found that the optimum cane length, as determined by the number of buds, is not a stable quantity, but is governed by the condition of the vineyard. Furthermore, the optimum cane length may vary from year to year in the same vineyard according to vegetative conditions. A definite optimum was more clearly observable in the less fruitful and less vegetative vineyards, leading the author to conclude that the relative length of the most fruitful canes apparently varies with the average fruitfulness of the vineyard and with the anticipated size of crop.

A study of the relation of point of origin of canes to yield showed that the highest average yield canes were generally formed from secondary branches. Observations on the relation of diameter of cane to productivity indicated an optimum cane diameter of 0.25 in. at a point midway between the fifth and sixth nodes.

Grape production in Michigan, N. L. PARTRIDGE (*Michigan Sta. Spec. Bul. 121 (1923), pp. 3–23, figs. 11*).—Commercial grape culture in Michigan is restricted almost wholly to the Concord variety and to certain limited areas in which the temperature and the length of the growing season is such that this variety can usually ripen. Climatological data from favorable and unfavorable grape regions indicate that an average mean temperature of at least 65.5° F. for the months of May to September, with a growing season something more than 160 days, is essential to success. Information is presented relative to soils, sites, propagation, planting, care of young vineyards, cultivation of bearing vineyards, cover crops, fertilizers, training and pruning, control of insect and fungus pests, harvesting, cost of production, varieties for the home garden, etc. The four cane Kniffen system of training is in general practice in Michigan, and it is suggested that the best length of cane is apparently 8 to 10 buds, making approximately 40 buds per vine. In respect to fertilizers, it is believed from results secured at Paw Paw that nitrogen is the most beneficial element. In fact, potash has shown no response. Nitrate of soda at the rate of 200 lbs. per acre is suggested as a satisfactory application.

Important grape varieties in Valencia (*Estac. Enol. Requena, Resumen Trab. 1921–22, pp. 19–34, figs. 35*).—Accompanied by photographic illustrations of the fruit and leaves, descriptive notes are given on several of the more important grape varieties grown in the Province of Valencia, Spain.

Cranberry growing in Massachusetts, H. J. FRANKLIN (*Mass. Agr. Col. Ext. Leaflet 72 (1923), pp. 14, fig. 1*).—This is a comprehensive discussion of cranberry growing, with information relative to the preparation and planting of bogs, their care, and the harvesting and marketing of the fruit.

Pollination of avocados, A. B. STOUT (*Calif. Cult., 60 (1923), No. 18, pp. 522, 526*).—In remarks of a preliminary nature concerning compatibility in the

avocado, the author points out that the pistils often develop before the pollen is shed in the same flower. However, it was observed that in certain self-fruitless varieties the pollen was shed while the stigma was apparently receptive, suggesting to the author the possible existence of physiological incompatibility, such as observed in the lily (E. S. R., 49, p. 141). A program of pollination studies is suggested to assist in the solution of this problem.

Breeding ornamental Hibiscus, N. B. MENDIOLA and J. M. CAPINPIN (*Philippine Agr., 11 (1923), No. 7, pp. 217–230, figs. 4*).—This paper, devoted for the most part to a description of hybrid Hibiscus seedlings developed at the Philippine College of Agriculture, also contains general information relative to the use and value of Hibiscus, species, and technique of breeding, and methods of propagation.

FORESTRY.

American forest regulation, T. S. WOOLSEY, JR. (*New Haven, Conn.: Tuttle, Morehouse & Taylor Co., 1922, pp. [15]+217, figs. 11*).—This book, the second part of which (pp. 105–174) is prepared by H. H. Chapman, constitutes a thorough discussion of the theories and practices of so regulating cutting as to maintain sustained yields in American forests.

Fifteen years of forestry, R. C. HAWLEY (*Jour. Forestry, 21 (1923), No. 3, pp. 225–230*).—Forestry operations carried on by the New Haven, Conn., Water Company since 1907 under the guidance of the Yale School of Forestry have shown a profit, not only in actual dollars but in the promoting of a better stream flow and better sanitary conditions. Cuttings are made on the basis of estimated mean annual growth per acre with a view to maintaining sustained yield. White and red pine, found to be the most suitable species for planting, were not able without assistance to maintain themselves against the hardwoods. On account of heavy grass sod, usually present on the planting sites, 3-year transplants were used in preference to smaller trees. The cost of growing and setting averaged $12.72 per acre of 1,200 trees. The shelterwood method of reproduction is believed to be the best way of establishing a new stand where the 70 or 80-year rotation is in operation. Hemlock, the only native conifer able to compete successfully with hardwood, has been found more productive than commonly thought and is, therefore, being encouraged.

The Wind River Forest Experiment Station, J. V. HOFFMAN (*West Coast Lumberman, 44 (1923), No. 518, pp. 118, 127, figs. 2*).—This is a brief statement relative to the activities, accomplishments, and purposes of this forest experiment station, located at Stabler, Wash.

Farming the forest for a pine crop, C. E. RANDALL (*Amer. Forestry, 29 (1923), No. 352, pp. 195–198, 250, figs. 5*).—The white pine (*Pinus strobus*), on account of its rapid growing character and the value of its wood, has already proved profitable in plantations in various parts of the white pine area.

Recent observations on the effects of turpentining on the structure of second-growth slash and longleaf pines, E. GERRY (*Jour. Forestry, 21 (1923), No. 3, pp. 236–241, pls. 2*).—This is a continuation of work previously noted (E. S. R., 47, p. 644).

Trees 5.4 in. in diameter were found to yield only half as much resin as trees 8 in. in diameter. Except for the thinning of stands, it is deemed unwise to begin tapping operations until trees are 10 in. in diameter at breast height. A comparison of one and two faces on small slash pine trees showed an increased yield the first year in favor of two faces, but in October of the second year the two-faced trees actually produced less gum than the one-faced trees and in many cases showed visible injury or dry facing. Larger trees have

often sustained two faces, but the yield is less than twice that from one face. Narrow chipping was found better than wide, in that it tended to keep the turpentining operation in the region of the most productive tissue.

The fuel wood situation and how it affects the practice of silviculture, F. W. Besley (*Jour. Forestry, 21 (1023), No. 3, pp. 231–235*).—Stating that there is an ample supply of wood suitable for fuel purposes, the author points out that it is in the small communities and on the farms that wood can best replace coal. It is suggested that many forest areas could be greatly improved by a systematic cutting of inferior trees, the removal of which would favor the development of those remaining and at the same time furnish an adequate supply of fuel.

Lumber cut of the United States, 1870–1920, R. V. Reynolds and A. H. Pierson (*U. S. Dept. Agr. Bul. 1119 (1923), pp. 63, pls. 2, figs. 16*).—This bulletin is prepared in two parts, the first of which, entitled significance of declining lumber production, emphasizes the seriousness of the lumber situation in the United States. The peak of production was reached in 1907 and since that time has steadily declined even in the face of unprecedented prices and demand for lumber. The production of lumber in 1920 was 33,800,000,000 ft. b. m., a decline of 2.2 per cent from the previous year. Charts are presented showing the output of lumber over a long period of years, the westward trend of production, and the upward mount of prices. Timber growing is deemed to be the only remedy, and, though necessarily beset with great difficulties, it is believed that it will be successfully accomplished when the need is sufficiently acute.

Part 2, entitled statistics of production and value, consists largely of tables relating to lumber production in the United States from 1870 to 1920, the data being arranged not only by States but also by principal species.

Common forest trees of Virginia, C. Jones (*Va. State Forester Bul. 26 (1922), pp. 64, figs. 62*).—Similar to that prepared for Maryland (E. S. R., 48, p. 840), this pocket manual describes the more common trees and notes their most important characteristics. Drawings of the twigs, leaves, and fruiting parts accompany the description of each species.

The bog forests of Lake Memphremagog: Their destruction and consequent successions in relation to water levels, F. E. Lloyd and G. W. Scarth (*Roy. Soc. Canada, Proc. and Trans., 3. ser., 16 (1922), Sect. V, pp. 45–48*).—The replacement of bog forests, originally composed of tamarack, cedar, spruce, and a few pines, with an altogether different forest composition, black ash, red maple, alder, willow, and dogwood, is believed to be due not so much to the actual raising of the water table through the construction of dams as to changes in the soil following the flooding with lime-containing waters and subjection to the increased fluctuation of the water table. Except where supported by durable structures such as old roots and logs, the original forest floor has settled noticeably, forming a broken and uneven surface. The soil in the depressions was found to be no longer fibrous raw humus but to have become a fine black muck.

New England forests in retrospect, A. F. Hawes (*Jour. Forestry, 21 (1923), No. 3, pp. 209–224*).—This is a historical account of the gradual devastation of the New England forests from the landing of the white man to the present time. According to the accounts of early visitors, the forests of New England were primarily rich in high-grade timber, which in the course of three centuries has been sacrificed in shipbuilding, exportation, and various home industries, until at the present time there remains only about 5 per cent of the original virgin forest. Practically none of the present timber is

of value as building material, but is adaptable for furniture, implement, and paper making. The author closes by stating that never in the history of New England has there been so much waste land as at the present time, and never has there been so great a need for systematic tree planting.

The forests of north Russia and their economic importance, E. P. STEBBING (*Jour. Roy. Soc. Arts, 71 (1923), No. 3676, pp. 416–429*).—This is a discussion of the forest resources of northern Russia and their potential possibilities for supplying the countries of western Europe.

Shelter belts and hedges at Ruakura: The experience of 20 years, A. W. GREEN (*New Zeal. Jour. Agr., 26 (1923), No. 3, pp. 133–139, figs. 5*).—Among a large number of forest species tested, *Cupressus lawsoniana* proved eminently satisfactory as a shelter-belt tree, whether grown naturally or trimmed annually. The tree was easily grown from seed, transplanted readily, was a fairly quick grower, and was found to be vigorous and hardy on a large number of soil types. The Douglas spruce (*Pseudotsuga taxifolia*) indicated value as a shelter-belt tree.

The various species tested are grouped according to their behavior.

Progress report of forest administration in Baluchistan for 1921–22, B. RAM (*Baluchistan Forest Admin. Rpt., 1921–22, pp. [26]*).—This report, like that of previous years (E. S. R., 48, p. 142), discusses forest protection, planting, exploitation, and general managerial activities.

Progress report on forest administration in the Punjab for the year 1921–22, A. J. GIBSON (*Punjab Forest Admin. Rpt., 1921–22, pp. [24]+ LXXVII, pl. 1*).—This is the usual report (E. S. R., 47, p. 644) relating to the various activities of the year, including alterations in area, protective measures, planting, general silvicultural management, and fiscal data.

DISEASES OF PLANTS.

The present status of plant pathology in agriculture, H. H. WHETZEL (*Quebec Soc. Protect. Plants, Ann. Rpt., 13 (1920–21), pp. 24–30*).—A review of the development of plant pathology is given, with views as to the place of this subject in agriculture.

Experimental work on the relation of soil temperature to disease in plants, L. R. JONES (*Wis. Acad. Sci., Arts, and Letters, Trans., 20 (1921), pp. 433–459, pls. 5, figs. 4*).—The results here presented have been selected primarily to explain what is essentially a new method of attack upon a group of phytopathological problems. The aim, broadly stated, is to gain a clearer understanding of the relation of environment to the occurrence of disease in plants, and the work deals with the relation of soil temperature to certain cases of soil parasites. It is insisted that plant pathologists must continue to inquire with increasing precision into the relation of environment to disease development, with the assistance of special workers in the related fields.

Studies in the physiology of parasitism.—IX, The effect on the germination of fungal spores of volatile substances arising from plant tissues, W. BROWN (*Ann. Bot. [London], 36 (1922), No. 143, pp. 285–300*).—In the course of an investigation of the exosmosis of nutrient substances from plant tissues into the infection drop (E. S. R., 48, p. 843), the observation was made that spores of *Botrytis cinerea* germinate better when petals of *Rosa centifolia* are placed in the same Petri dish, but out of contact with the water drops in which the spores are sown, than when they are absent. It was later found that the capacity to stimulate and, more generally, to influence the germination of fungus spores in some way or other by means of some volatile emanation could be demonstrated in case of a large number of plants. The present work, though of a preliminary nature, shows that volatile substances of plant origin may

play a considerable part in influencing the germination of the spores of fungus parasites.

The usual method of experiment was to lay the plant organs in question in large dishes side by side with clean slides on which drops of an aqueous suspension of spores were placed.

The experiments described point to a marked degree of sensitiveness on the part of fungus spores to the presence of traces of volatile organic substances in the atmosphere to which the spores are exposed during germination. Such stimulation is demonstrable only when the spores are placed in conditions of very limited food supply, as in pure water. Since the behavior of spores in water is important in pathology, the bearing of the results of this work on disturbing atmospheric factors in the laboratory is detailed with discussion.

The germination of spores of *B. cinerea* is increased by the action of volatile substances arising from certain plant tissues, as apple leaves and fruit and leaves of Ruta and Eucalyptus. In other cases reduced germination or even inhibition is produced. This is true of potato tuber, onion leaves, or bulb scales. Reduced spore germination due to volatile substances produced by growth of organisms in wet filter paper or blotting paper is described. Similar stimulating and retarding effects can be produced by the action of simple chemical substances such as ethyl acetate. A number of other fungi were tested in these respects and found to behave similarly to *B. cinerea.*

[Report of the Idaho Station on] plant pathology (*Idaho Sta. Circ., 30 (1923), p. 10*).—Investigations of this station are said to show that the amount of smut infection in wheat increases as the amount of moisture is increased up to saturation. The highest infection developed at the lowest temperature.

A survey made of the potato regions of the State is said to have shown that mosaic and leaf roll are very common and each year cause an increased amount of damage. Study of the calico and russet dwarf disease of the potato is reported to have shown that the calico disease is apparently transmitted not only by means of the diseased tubers, but it is also spread from plant to plant in the field.

[Report of] division of plant pathology, F. D. Heald (*Washington Col. Sta. Bul. 175 (1922), pp. 34–40*).—A summary is given of investigations on wheat smut and its control, the data being largely drawn from experiments previously described (E. S. R., 48, p. 452).

Investigations were continued on the foot rot of wheat, but as the season was marked by a slight rainfall and high temperature the disease which had been so severe in the previous season did not appear. Laboratory and greenhouse studies have been continued in an effort to determine the identity of the fungus, but thus far no fruiting stage has been found and the identity of the organism remains in doubt.

Preliminary investigations on the covered smut (*Ustilago levis*) of oats showed that copper carbonate dust, while not so effective as for the control of bunt on wheat, gave results that are considered sufficiently promising for further investigation.

Investigations on cranberry pests have been begun, and considerable losses due to storage rots were reported. Some of these losses are attributed to the entrance of fungi following injury caused by fireworm, which was not controlled by nicotin sprays in the experiments reported upon.

Continued investigations are reported on the Rhizoctonia disease of potatoes, and tubers treated with copper carbonate gave results which, although rather erratic, are considered sufficiently promising to be worth repeating. The effect of time of planting on the occurrence of Rhizoctonia diseases was tested by makings plantings at intervals of two weeks from early in April until July, and

the midseason plantings gave the largest total yield and also the largest yield of table stock. The last planting, made July 1, gave the largest percentage of clean tubers. To determine the relation of Rhizoctonia to leaf roll, mottling, streaking, and curling of foliage, cuttings were taken from potato plants and an attempt made to root them. Only a small percentage of cuttings from the less severely diseased plants rooted, and these were grown to determine the symptoms carried over into the resulting plants.

A study of the western yellow blight of tomato was continued, and from the behavior of diseased plants and the results of previous experimental work it is suggested that this disease is one of the so-called virus troubles. Four hundred and twenty cuttings were made from diseased plants, and only 30 were successfully rooted. The failure of the cuttings to recover from the diseased condition is believed to strengthen the theory of the virus origin of this disease. Continued studies were made of the fungi occurring on the root system. The mycelium of Rhizoctonia was abundant on all, and 57 per cent of the specimens showed pronounced sclerotial development taking place.

Notes are given on a plant disease survey carried on cooperatively between the station and the U. S. Department of Agriculture, from which it appears that an aecial stage of *Puccinia coronifera* was abundant on buckthorn (*Rhamnus purshiana*) in western Washington. It is considered worthy of note that a single collection was made of the aecial stage of stem rust (*P. graminis*) on barberry at Mt. Vernon. The aecial stage of *P. sarcobati* was found common on spinach in a truck section of southeastern Washington, and the rust was found to overwinter on salt grass (*Distichlis spicata*), a common roadside plant.

Among new diseases reported during the year are a storage rot of apple due to an undescribed species of Dothichiza, downy mildew of garden peas caused by *Peronospora riciae*, and a dry rot of rhizomes of ginseng caused by Ramularia.

Notes on parasitic fungi in Wisconsin, VII, VIII, J. J. Davis (*Wis. Acad. Sci., Arts, and Letters, Trans., 20 (1921), pp. 399–411, 413–431c, pls. 3, figs. 4*).—A continuation of the plan and procedure previously noted (E. S. R., 42, p. 350), with an index of the hosts and parasites referred to.

Report of the phytopathological service, 1920–21, N. van Poeteren (*Verslag. en Meded. Plantenziektenkund. Dienst Wageningen, No. 27 (1922), pp. 92, pls. 2, figs. 1*).—This report deals very summarily with diseases affecting plants extending over a wide systematic range of hosts, including many plants of economic importance.

On the parasitic habits of the plasmodium of Physarum viride rigidum, A. R. Sanderson (*Brit. Mycol. Soc. Trans., 7 (1922), pt. 4, pp. 299, 300*).—These notes refer to the habitat of the plasmodium of *P. viride rigidum* as seen in tropical Malay, where it is one of the most common and widely distributed species, especially on decaying *Hevea brasiliensis*. It appeared to be parasitic on pilei of *Schizophyllum commune* and on *Hirneola hispida*, but not on *Daldinea concentrica*, *Nummularia pithodes*, and *Ustulina zonata*.

The saprophytic life of Phytophthora in the soil, H. L. G. De Bruyn (*Meded. Landbouwhoogesch. [Wageningen], 24 (1922), No. 4, pp. 38, pls. 2*).—An account in English, with a summary in Dutch and a list of related literature, is given of the author's studies on the saprophytic life in the soil of species of Phytophthora, in particular of *P. syringae*, *P. erythroseptica*, and *P. infestans*.

It is concluded from results of the researches that members of the genus Phytophthora are not the obligate parasites that they were formerly considered to be. The experiments here described are claimed to show that the three species above named can live in bog soil, leaf mold, clay, or sand. They can

resist soil desiccation to a considerable extent, and *P. syringae* and *P. erythroseptica* can sustain low winter temperatures without losing their vitality. Pathogenicity is not weakened in any of the three by cold weather. Examination of the literature raises the presumption that most species of Phytophthora can develop as saprophytes in the soil, this fact preventing any good results from rotation.

As to the overwintering in the soil of *P. infestans*, no answer could be obtained. The fact that blight attacks potato plants more heavily on clay than on sandy soils may be connected with the fact that the fungus thrives better on clay than on sand. It is thought possible also that manure, by increasing the organic material in the soil, may influence the attack of *P. infestans*.

Germination of teliospores of Puccinia antirrhini, J. F. HOCKEY (*Quebec Soc. Protect. Plants, Ann. Rpt., 13 (1920–21), pp. 54–57, figs. 4*).—Snapdragon (*Antirrhinum majus*) rust (*P. antirrhini*) teliospores, not previously known to have been recorded as responding to experiments seeking to germinate them, were germinated (in percentages ranging from 12 to 22) under conditions and treatments here briefly indicated. Seedling plants of *A. majus* were inoculated with germinating teliospores bearing sporidia, teliospores from plants which had been frozen two weeks, and viable urediniospores, the last mentioned being the only cases of successful inoculation. These developed characteristic uredinia in about two weeks.

Parasitic fungi internal of seed corn, T. F. MANNS and J. F. ADAMS (*Jour. Agr. Research [U. S.], 23 (1923), No. 7, pp. 495–524, pls. 13*).—Cultural and germination studies of field seed corn in Delaware are said to show the presence of at least four fungus parasites, and a survey of field corn from 21 other States indicates a similar prevalence of these organisms. The four parasites consistently found are *Cephalosporium sacchari, Fusarium moniliforme, Gibberella saubinetii,* and *Diplodia zeae.* In addition to these organisms, species of Aspergillus, Cladosporium, Penicillium, Alternaria, Helminthosporium, Rhizopus, Spicaria, Hormodendrum, Torula, Chaetomium, Colletotrichum, and several bacteria were found within the seed coats of corn.

It is claimed that there are no uniform symptoms to associate the infection of field corn with these parasites that can be consistently described. Normal appearing kernels may be infected without showing any external symptoms. No conclusive evidence was secured which indicates the manner in which infection becomes established in the seed.

Early vigor of maize plants and yield of grain as influenced by the corn root, stalk, and ear rot diseases, J. R. HOLBERT, W. L. BURLISON, ET AL. (*Jour. Agr. Research [U. S.], 23 (1923), No. 8, pp. 583–630, pls. 7, figs. 20*).—A report is given of studies conducted with diseased and apparently disease-free seedlings transplanted from the germinator to the field. The disease-free seedlings made more rapid increases in height and circumference than the diseased seedlings during the first 25 days. The plants developed from disease-free seedlings gave a much higher yield of grain than those from diseased seedlings. Early height and yield of corn plants were found to be correlated directly. Plants that were strong and vigorous in their early stages of growth produced the largest percentage of good-sized ears, and therefore gave higher yields of grain and matured their grain earlier than weaker ones. Corn grown from seed not infected with any of the fungi or not susceptible to the root and stalk rots had a higher percentage of strong, vigorous plants and a lower percentage of weak ones. Relatively disease-free seed ears selected from badly rotted plants proved to be inferior to relatively disease-free seed ears selected from apparently disease-free plants. Corn resistant to root and stalk rots was also found resistant to ear rots.

The authors claim that the importance of the disease factor demands that it be given consideration in any program connected with the permanent improvement of the corn crop.

Genetics of bunt resistance in wheat, E. F. GAINES (*Jour. Agr. Research [U. S.], 23 (1923), No. 6, pp.445–480, pls. 3, figs. 2*).—The results are given of studies on the comparative resistance of different wheats and the inheritance of the factors that cause resistance to *Tilletia tritici*, as expressed in the hybrid segregates of succeeding generations. In the author's investigations, which covered a period of seven years and embraced detailed account of eight varieties of wheat, the most susceptible ones, when planted under conditions favoring maximum infection, were found to produce an average of about 80 per cent of bunted heads, and, although they produced 20 per cent of sound heads, this is believed to be due to accident, for in crosses with other varieties the descendants did not show any evidence of having inherited any cumulative resistance from these varieties.

Several varieties possessing differing dilute resistances reduced the amount of bunt by from 10 to 25 per cent. When crossed, the cumulative effect of resistance becomes more concentrated, and from 30 to 60 per cent of the plants are free from disease. In the case of three varieties, each having differing concentrated resistances, the amount of bunt is reduced from 70 to 75 per cent, compared with standard susceptible varieties. These concentrated resistances are said to be cumulative in effect when brought together by crossing, the resulting descendants segregating into immune, very resistant, various stages of dilute resistant, and completely susceptible classes.

The Helminthosporium foot rot of wheat, with observations on the morphology of Helminthosporium and on the occurrence of saltation in the genus, F. L. STEVENS (*Ill. Nat. Hist. Survey Bul., 14 (1922), Art. 5, pp. IV+76–185, pls. 54, figs. 23*).—The present study (with bibliography) of wheat disease is based upon a foot rot or rot of the basal portion of the stems of wheat plants as it occurred in Madison County, Ill., in 1919 and subsequently. In May, 1921, the author published the statement (E. S. R., 43, p. 445) that this foot rot of wheat had been shown to be caused by Helminthosporium. One purpose of the present paper is to present the evidence on which the foregoing conclusion is based and certain facts concerning the morphology and parasitism of the fungus, but of greater interest than the disease itself (which now appears to be less dangerous than at first supposed) is the fact that very striking phenomena of variability are found in this and related fungi. This article, therefore, gives an account of the Illinois foot rot of wheat and its causal fungus, and also evidence and discussion of the occurrence of saltation within the genus Helminthosporium.

The evidence is considered complete that Helminthosporium causes foot rot at the base of wheat stems. The study has also shown this Helminthosporium to be a root parasite. This phase of the disease has been studied only incidentally, but it is deemed worthy of searching investigation since it may lead to the rosetting often associated with foot rot, and thus predispose the plant to this trouble. This Helminthosporium is the only organism constantly present in the rotting base of wheat plants.

The culture characters of this fungus were studied on many media and under many and various environmental conditions. Slight changes of nutriment, as afforded by small differences in agar formulas or by the temperature at which the agar was made, produced marked effect on growth characters. Of many agars tried, corn-meal agar proved to be most useful. Cereal shoots autoclaved served as a still more favorable medium.

Morphological characters are largely altered by environment. Quantity as well as quality of food produces change in characters. Humidity has an influence on the production and length of conidia, on the aerial mycelium, and on sclerotial formation. The optimum growth temperature is about 25° C. A marked effect was noted of nutrition conditions on conidial length, shape, and septation. It follows that collections in order to be comparable must be made under similar conditions as regards the factors mentioned. A procedure to secure standard conditions for study of the fungus was devised. The mycelium, aerial and submerged, is described. The cells bear several nuclei. The senescent mycelium undergoes autodigestion.

The etiological relation of the Helminthosporium (H. No. 1) to foot rot was demonstrated by its constant presence, by the absence of other parasites, and by its proved ability to cause infection and rotting under various conditions as by inoculation of seedlings in Petri dishes, in rag-doll germinator, and in soil. The fungus was shown to enter cells of the leaf sheath, stem, and root.

A study of the infection phenomena shows important changes in the cell walls of the host and the development of appresoria and a callus-like formation. Many strains of Helminthosporium, some different morphologically from others, can produce some or all of the phenomena of infection. Alternaria produces some of the marks of infection, including the changes in the host cell, the callus, and entrance into the host cell. Penicillium can not do this.

Wheat, corn, barley, rye, sorghum, Sudan grass, and millet are more or less susceptible to Helminthosporium rot. Saltation, possibly mutation, is common in certain races of Helminthosporium. The saltants were, in the main, permanent in character, though what appeared to be reversions sometimes occurred.

The Helminthosporium that causes wheat foot rot belongs to the *H. sativum* group, which consists of a large number of elementary species.

Hydrogen-ion concentration and varietal resistance of wheat to stem rust and other diseases, A. M. Hurd (*Jour. Agr. Research* [*U. S.*], *23* (*1923*), *No. 5, pp. 373–386*).—A report is given of an investigation undertaken for the purpose of furnishing data on the H-ion concentration of the expressed juice of a number of wheat varieties, some resistant and others susceptible to stem rust (*Puccinia graminis tritici*).

From the data presented it appears that there is no correlation between the H-ion concentration of the expressed juice and the resistance or susceptibility of wheat varieties to disease. Environmental factors were found to produce much greater differences in the H-ion concentration of the juice than were ever observed between varieties or between plants of different ages grown under identical conditions. The pH value of the juice of wheat plants grown in the greenhouse is said to have averaged 0.1 higher when the plants were cut at 1 p. m. than when they were cut at about 9 a. m.

The H-ion concentration of the juice of wheat plants grown in limed soils was lower than that of plants grown in unlimed soils, and a lack of vigor as shown by an unhealthy appearance of wheat plants is said to be always accompanied by an abnormally high acidity of the expressed juice. Plants badly infected by mildew (*Erysiphe graminis*) were found to be more acid than adjacent plants free from infection. The geographic source of the seed was not found to affect the H-ion concentration of the juice of the plants, and the concentration of H-ions in the juice was found to increase on standing.

[The effect of] seed treatment, C. E. Hill (*Washington Col. Sta. Bul. 175* (*1922*), *p. 62*).—Treating seed wheat with dry copper carbonate is said to have given satisfactory results in the control of smut without causing any injury to the germination of seed when grown under dry-land conditions.

Ear deformation in grain, A. Succi (*Italia Agr., 58 (1921), No. 10, pp. 292–298, figs. 5*).—Cases of wheat deformation are referred chiefly to retention of the spike when it should emerge normally from the sheath.

Cotton root rot in Arizona, C. J. King (*Jour. Agr. Research [U. S.], 23 (1923), No. 7, pp. 525–527*).—Investigations carried on at Sacaton, Ariz., are said to show that the fungus *Ozonium omnivorum*, which causes root rot of cotton and alfalfa, fruits abundantly in favorable seasons, the fruiting masses being identical with those described by Duggar (E. S. R., 36, p. 146). The fungus is said to spread from the center after the manner of a fairy-ring fungus. Plants were successfully inoculated with pure cultures of the mycelium. The spores are said to germinate with difficulty and were not successfully used as a medium of inoculation. It is claimed that the spread of the disease may be checked by thoroughly saturating the soil with a formaldehyde solution to a depth of 4 ft. in advance of the circular area of distribution.

Cotton wilt, a seed-borne disease, J. A. Elliott (*Jour. Agr. Research [U. S.], 23 (1923), No. 5, pp. 387–395, pls. 2*).—The author reports having isolated from strongly surface-sterilized cottonseed the wilt organism, *Fusarium vasinfectum*, indicating that the organism is at times carried on the inside of the seed coat. The pathogenicity of the organism was proved by inoculation experiments. Artifically inoculated seed are reported to have carried the organism in a viable condition on the seed lint for at least five months. The wilt disease was introduced into wilt-free soil by the planting of artifically infected seed. It is recommended that badly infected fields be rejected as a source of seed for planting.

Bacterial spot of cowpea, M. W. Gardner and J. B. Kendrick (*Science, 57 (1923), No. 1470, p. 275*).—The authors describe a rather destructive bacterial disease of cowpeas characterized by spots on the leaves, stems, and pods that has been noted as occurring in Indiana since 1919. Numerous isolations and successful inoculations have proved that the disease is due to a species of bacteria to which the name *Bacterium vignae* n. sp. is given. The technical description of the bacterium is appended.

The disease is said to be seed borne, and it is believed that it may be avoided by using seed from disease-free pods.

Control of lettuce drop by the use of formaldehyde, W. S. Krout (*Jour. Agr. Research [U. S.], 23 (1923), No. 8, pp. 645–654, pl. 1, figs. 3*).—The results are given of a study on the control of lettuce drop due to *Sclerotinia libertiana*, made to devise a method of soil sterilization to supplant the steam sterilization previously recommended (E. S. R., 12, p. 856). Laboratory and greenhouse studies were made to determine the effect of various dilutions of formaldehyde on the sclerotia and mycelium of the fungus, and the maximum time required to kill the different forms of fungus growth and the strength of solution necessary were determined. Formaldehyde solutions were found more effective if the sclerotia were not in a desiccated condition, and from this fact it is claimed that the soil in greenhouses should be maintained in a moist condition for from 5 to 10 days immediately preceding the formaldehyde treatment.

As the result of a 4-year test a 1:100 formaldehyde solution was found an effective soil fungicide when used to control *S. libertiana* in greenhouse soils.

Gummosis in Arachis hypogaea, B. T. Palm (*Dept. Landb., Nijv. en Handel [Dutch East Indies], Meded. Inst. Plantenziekten, No. 52 (1922), pp. 41, pls. 2*).—In this account, with English summary, it is stated that peanut (*A. hypogaea*) bacterial wilt, first discovered in the Dutch East Indies by Van Breda de Haan in 1905, has now been reported in a considerable number

of provinces, the loss in some cases reaching 25 per cent. The organism always proves to have spread beyond the limits of the evident symptoms. The cultural characters are described, as are experiments infecting all plants inoculated of peanut, tobacco, and tomato. Several weeds are liable to the disease.

Measures recommended include planting during the dry monsoon; avoidance of planting Arachis two years in succession, of heavy clay soils, and of seeds not known to be healthy; and destruction of affected plants.

The influence of copper sprays on the yield and composition of Irish potato tubers, F. C. Cook (*U. S. Dept. Agr. Bul. 1146 (1923), pp. 27*).—Studies are reported on the changes in composition of potato tubers during growth, effect of copper sprays on yield and composition of tubers, proportion of tubers to vines, and the influence of strength and number of applications of copper sprays on composition of tubers.

The results of investigation seem to indicate that copper sprays not only increase the yield of potatoes in various sections of the country, but favorably influence their composition. Such tubers analyzed throughout the period of growth were usually higher in solids, starch, and nitrogen than tubers from unsprayed vines. Bordeaux mixture, Pickering Bordeaux mixture, and barium water and copper sulphate were tested, and the data indicate that the increased yield and increased solids of the tubers apparently depend on the presence of copper in the spray. When a lime spray containing no copper was used, the yields of tubers were decreased. It is claimed that, in addition to plant disease and insect control, copper in the fungicide exerts a stimulating action on the potato plant.

Spraying of potatoes for blight or potato disease (Phytophthora infestans), S. Pennington and H. G. Robinson (*Univ. Col., Reading, Bul. 30 (1921), pp. 8, pl. 1, fig. 1*).—The experiments here described record systematic tests during nine years under field conditions with the ordinary field sprayers.

From the particulars of the trials as outlined, it appears that spraying has increased the total yield of all the plats on an average during the nine years. One late spraying has given perhaps slightly better results than one early spraying, but the double spraying has proved its superiority. In every case spraying has increased the total crop on the average, and has also increased the percentage of sound salable potatoes. The explanation of this increase in crop of salable tubers is probably due to the fact that spraying gives the crop a longer growing period, more tubers thus acquiring suitable size.

In every case, except in 1915, the percentage of disease was greater or smaller according to the rise or fall in precipitation during June, July, and August.

Rhizoctonia of potatoes, R. P. Bean (*Washington Col. Sta. Bul. 175 (1922), p. 52*).—A brief account is given of the effect of treating potato tubers with corrosive sublimate and the influence of periodic plantings from April 1 to July 15 on the yield and occurrence of disease under irrigated conditions. The percentage of clean tubers in table stock was increased from 80.3 to 93 per cent where clean seed was used, and from 19.7 to 80.1 per cent for infected seed tubers. Plantings made from May 15 to July 1 had less infection and produced a greater yield of salable potatoes than earlier plantings.

A spindling-tuber disease of Irish potatoes, E. S. Schultz and D. Folsom (*Science, 57 (1923), No. 1466, p. 149*).—Investigations by the authors are said to have shown that a condition of potatoes commonly designated as "running-long" or "running-out" is an infectious disease. In their experiments the disease has been transmitted to healthy plants by means of tuber grafts, vine grafts, leaf-mutilation inoculation, and plant lice.

A bacterial leaf spot of tobacco, J. JOHNSON (*Jour. Agr. Research* [*U. S.*], *23* (*1923*), *No. 6, pp. 481–494, pls. 4*).—A bacterial leaf spot of tobacco is said to have been under observation and study in Wisconsin for five years. This disease is said to differ from wildfire leaf spot and angular leaf spot as they occur in the United States, and from the black rust of Java, all of which are of bacterial origin. The disease usually manifests itself by round, brown, or rust colored spots, usually less than 0.5 in. in diameter, but frequently running together to form larger irregular lesions. Frequently the young lesions are marked by a distinct chlorotic area or halo surrounding the point of infection. The disease is said to be caused by a yellow bacterial organism, which is given the name *Bacterium melleum* n. sp.

Artificial infection by this organism has been secured only through wounding by needle pricks, although under field conditions it is not believed that wounding is necessary. It is believed that the disease ordinarily starts in the seed beds, from which it is transferred to the field, and growers are advised not to use plants from infected seed areas for transplanting.

Apple rosette, O. M. MORRIS (*Washington Col. Sta. Bul. 175* (*1922*), *pp. 30, 31*).—Apple rosette, which appears to be peculiar to the Northwest, is said by the author not to have been found east of the irrigated belt on the east slope of the Rocky Mountains or west of the Cascade Mountains, and it occurs only in alkali soil districts. The disease is characterized by a chlorosis of the foliage and long narrow leaves much smaller than normally. The effect of the disease is cumulative, and the twigs that are excessively shortened in one season usually die the following year. Affected twigs grafted as scions into normal wood usually die, but those that live assume their normal growth and vigor.

Chemical analysis showed that the rosetted twigs and foliage had a higher ash and nitrogen content than the normal twigs.

It is said that in practically every case the disease disappeared within three years after an orchard was planted to a leguminous cover crop.

Further studies of the brown rot fungi.—I, A shoot wilt and canker of plum trees caused by Sclerotinia cinerea, H. WORMALD (*Ann. Bot.* [*London*], *36* (*1922*), *No. 143, pp. 305–320, pls. 2*).—In May, 1919, Victoria plum trees in the fruit plantation at Wye College, examined for withertip and described in a previous contribution (E. S. R., 40, p. 850), showed practical arrest of growth in some terminal shoots. Others were dead, though no withertip was observable. Early in June cankers developed around the branches at the insertions of these shoots, in some cases girdling the twigs and killing the distal portions. These cases were brought under observation and study as here noted.

In the wilt here described of the short shoots of Victoria plum the shoots are killed soon after the leaves unfold, and mycelium extends from the dead shoots into the twigs bearing them, causing cankers. The disintegration of the infected parts results in gummosis of the tissues, and gum often exudes in drops. A necrosis of the young xylem elements can be traced for several centimeters below and above a canker, to which, however, the mycelium itself is limited.

The fructifications of *Monilia cinerea* may appear on the infected leaves in summer and on the cankers the following winter and spring. Shoot wilt has been induced on plum trees by inoculating punctured leaves with conidia of the fungus grown in pure cultures. The fungus causing the disease is said to be *S. cinerea pruni.*

Black measles, water berries, and related vine troubles, F. T. BIOLETTI (*California Sta. Bul. 358* (*1923*), *pp. 509–524, figs. 6*).—The author describes the California vine disease, black measles, and water berries, all of which are considered as different stages or types of the same disease. They are all attributed to overbearing, weak vine growth from any cause, and a lack

of sufficient moisture. The California vine disease is the most severe form, and it may destroy entire vineyards. Black measles is less destructive and is characterized by the spotting and drying of the berries. The term "water berries" is applied to grapes lacking in color, flavor, and sugar. In moderate cases, proper pruning, fertilization, and adequate cultural measures will usually restore the vines.

Investigations on export citrus fruit from South Africa during 1921, M. R. H. THOMSON, V. A. PUTTERILL, and G. HOBSON (*Union So. Africa Dept. Agr. Bul. 1 (1922), pp. 69, pls. 23, figs. 7*).—During the citrus season of 1920 a comprehensive investigation into the cause of waste in export citrus fruit was made and reported by the authors (E. S. R., 46, p. 652). These studies were continued during the season of 1921, and the results are published in the present bulletin, a summary account of this work and some important results by I. B. P. Evans preceding the detailed reports.

Experimental shipments have shown that, in spite of the many disadvantages of both cold storage and ventilated hold, fruit can be landed overseas in excellent condition with practically no waste if treated with the necessary care. Ventilated hold fruit, though not so fresh in appearance as cold storage fruit, keeps in a salable condition up to 16 days. The elimination of waste depends upon care in handling.

Observations during the past season have fully confirmed the claim that cold storage citrus fruit, especially when kept at a temperature below 40°, can be detected by its flavor. This may be due to the fact that the cold kills the cells, thus allowing the acrid tasting contents of the skin to penetrate the juicy part.

The present investigations emphasize how little is really known about the conditions under which citrus should be grown in South Africa and exported, and they show how important it is that further work be undertaken by competent mycologists, especially with regard to the accumulation of carbon dioxid in the ships' chambers.

Investigations on export citrus fruit from South Africa during 1921, Thomson (pp. 9–39).—An account is given of a continuation of experimentation previously noted on the storage of fruit at low and at high temperatures, and experimental shipments and conditions related to the initiation of rot.

A high temperature does not in itself cause waste, but it does permit rapid deterioration in fruit which has been carelessly handled and causes rapid wilting. A temperature as low as 40° gives rise to a brown discoloration of the skin, and a medium temperature is recommended. Citrus fruits should be stored in a chamber supplied with clean, fresh air in constant circulation, and kept between the temperatures 43 to 48° or 45 to 50°. Much depends on the quality of the wrappers used, as wrappers of good quality lessen deterioration. A special wax tissue wrapper has been used with success, preventing wilting and isolating fruit which has become wet rotted. It is thought that such wrappers should prove invaluable in shipments employing the new ventilated hold.

Observations on the export of oranges from South Africa during the season 1921, Putterill (pp. 40–47).—Provided the fruit is carefully handled and satisfactory transport facilities are available, no reason is seen why Transvaal oranges should not arrive on overseas markets in perfect condition.

Observations on the overseas markets during the 1921 citrus season, Hobson (pp. 48–61).—Emphasis is laid on what is claimed as an established fact that fruit carefully picked, graded, sized and packed, and stowed on train and boat will, even under reasonably adverse conditions, reach its destination in a sufficiently sound and attractive condition. It is claimed that 80 per cent of waste

could be eliminated, and that it would be possible, when necessity arises in the form of bad markets, to hold over such fruit for 14 to 16 days without any serious fall in value due to deterioration.

Observations on a discomycete found on medlar fruits, H. WORMALD (*Brit. Mycol. Soc. Trans., 7 (1922), pt. 4, pp. 287–293, figs. 2*).—Cultures of the fungus previously noted (E. S. R., 45, p. 822) were subjected to studies which are described. The present account states that mummied medlar fruits collected from the ground in spring and placed on soil in a pot in the open gave rise to fructifications of a discomycete in the following spring. The fungus differs but slightly from *Sclerotinia mespili* as described by Schellenberg, the differences noticed being that the ascospores are distinctly narrower and that the stalk of the apothecium develops from the apex of the primary protuberance and not from the base.

On the symptoms of wilting of Michaelmas daisies produced by a toxin secreted by a Cephalosporium, W. J. DOWSON (*Brit. Mycol. Soc. Trans., 7 (1922), pt. 4, pp. 283–286*).—An investigation of a serious and widespread wilt disease of Michaelmas daises undertaken at Wisley in the autumn of 1920, led to the conclusion that the symptoms of the disease are due to the secretion of a toxic substance by the parasite.

The first outward sign of disturbance, namely, the mottling, is due to the action of a toxin on the assimilating tissue, and corresponds with the migration of the chloroplasts, whereby a space devoid of these bodies is left in a large number of cells. The final bright yellow appearance of the leaves, so typical of wilt diseases, is due to the yellow fused-up mass of chloroplasts at the ends of the palisade cells.

Bacterial leaf spot of geranium in the eastern United States, N. A. BROWN (*Jour. Agr. Research [U. S.], 23 (1923), No. 5, pp. 361–372, pls. 3*).—A bacterial leaf spot disease of the cultivated geranium is said to occur quite widely in the Eastern States, being mostly a greenhouse disease, but it is sometimes present on plants grown out of doors.

The organism causing this disease was isolated from diseased plants and the disease reproduced on the leaves of healthy plants. The name *Bacterium pelargoni* n. sp. is proposed for the organism, and a technical description of it is given.

Care in regulating the temperature, air, and moisture conditions in the greenhouse, and the removal of all spotted leaves are recommended as control measures.

Some wood-staining fungi, B. D. MACCALLUM (*Brit. Mycol. Soc Trans., 7 (1922), pt. 4, pp. 231–236, pls. 2*).—The author finds, with Münch (E. S. R., 20, p. 1046), that *Graphium penicillioides* must be considered as a stage in the life history of *Ceratostomella piceae.*

ECONOMIC ZOOLOGY—ENTOMOLOGY.

Conservation laws of Maryland (*Baltimore: Conserv. Comn. Md., [1922], pp. 123*).—This is a compilation of the laws relating to wild fowl, birds, game, and fish effective June 1, 1922, to June 1, 1924.

Beaver farming, V. BAILEY (*Jour. Heredity, 13 (1922), No. 7, pp. 315–318, figs. 5*).—This is a brief discussion of the subject based upon investigations by the author.

Observations on the burrowing habits of moles (Scalopus aquaticus machrinoides), F. L. HISAW (*Jour. Mammalogy, 4 (1923), No. 2, pp. 79–88, figs. 3*).—A report of studies conducted at the Kansas Experiment Station in connection with those previously noted (E. S. R., 48, p. 649).

Bird biographies, A. E. Ball (*New York: Dodd, Mead & Co., 1923, pp. [20]+295, pls. 56*).—This is a popular account of 150 land birds of the eastern United States, many of which are illustrated by colored plates prepared by R. B. Horsfall.

A local investigation of the food of the little owl, W. E. Collinge (*Jour. Min. Agr. [Gt. Brit.], 29 (1922), No. 8, pp. 750–752*).—The results obtained by this investigation of the stomach contents of 98 birds taken in a local area where game birds are very generally reared shows that the bulk of this owl's food during June and July consists of neutral and injurious insects, voles and mice, and earthworms, and but a negligible percentage of game birds.

Entomological reminiscences: Studies of the instincts and habits of insects, I–VII, J.-H. Fabre (*Souvenirs Entomologiques: Etudes sur l'Instinct et les Moeurs des Insectes. Paris: Libr. Delagrave, Éd. Définitive, 1914, 1. ser., pp. VII+375, pls. 16, figs. 42; 1920, 2. ser., pp. [6]+370, pls. 16, figs. 58; 1921, 3. ser., pp. [5]+458, pls. 16, figs. 49; 4. ser., pp. [5]+358, pls. 16, figs. 32; 1922, 5. ser., pp. [5]+383, pls. 16, figs. 30; 6. ser., pp. [5]+452, pls. 16, figs. 51; 1923, 7. ser., pp. [5]+423, pls. 16, figs. 42*).—This is an illustrated edition of the author's entomological writings, of which English translations have been noted as separate volumes (E. S. R., 30, p. 552; 32, p. 758; 35, p. 468; 37, p. 358; 38, p. 359; 40, p. 552; 41, p. 759).

The respiration of insects, A. Krogh (*Jour. Wash. Acad. Sci., 13 (1923), No. 8, pp. 160–162*).—This is an abstract of an address presented before the Washington Entomological Society in which data from several papers by the author are summarized.

Insects injurious to Arizona crops during 1922, compiled by P. A. Glick (*Ariz. Comn. Agr. and Hort. Ann. Rpt., 14 (1922), pp. 55–77, figs. 9*).—Insects attacking fruits and vines, citrus and subtropical fruits, field and forage crops, vegetables and truck crops, cotton, and shade trees and ornamentals, respectively, and household insects are considered in this account.

Eighth biennial report of the Kansas Entomological Commission for the years 1921–1922 (*Kans. Ent. Comn. Bien. Rpt., 8 (1921–22), pp. 20*).—This includes reports on nursery inspection work, in the north half of the State by G. A. Dean (pp. 5–8), and in the south half of the State by S. J. Hunter (pp. 8–12); a report on apiary inspection work by J. H. Merrill (pp. 12–14); and an account of Education along Beekeeping Lines in the United States, by Merrill (pp. 14–20).

Grasshoppers, cutworms, and other insect pests of 1921–1922, R. A. Cooley (*Montana Sta. Bul. 150 (1922), pp. 31, figs. 6*).—This is the nineteenth report of the State entomologist of Montana. It reports work with grasshoppers, the pale western cutworm (*Porosagrotis orthogonia* Morr.), fruit-tree leaf-roller (*Archips argyrospila* Wlk.), blister mite, and granary weevil during 1921 and 1922, and contains accounts of the other insect pests of these years.

Economic entomology [in Pennsylvania] (*Pennsylvania Sta. Bul. 176 (1922), pp. 16, 17*).—This reports briefly upon the work of the year with the apple leaf roller (*Eulia velutinana* Wlk.) and its control, the red spider and its control, millipedes affecting truck crops, cabbage maggot control on cruciferous crops, plant lice affecting truck crops, red bug investigations, and the peach mite *Phyllocoptes cornutus* Banks.

[Report of the] division of entomology, A. L. Melander (*Washington Col. Sta. Bul. 175 (1922), pp. 21–25*).—This report deals briefly with investigational work with the San José scale, codling moth, leaf roller (E. S. R., 48, p. 553), cranberry fireworm, soil treatment of subterranean insects, and the spray poisoning of bees.

Work with the San José scale shows that the particularly resistant form found at Clarkston can not be controlled by sprays consisting of sulphur. In investigations of the value of spreaders in control work with the codling moth, it was observed that their omission did not detract from the insecticidal value of an application, and that doubling the usual strength of lead arsenate did not increase the efficiency of the spray. However, the fruit sprayed with a spreader, whether casein, soap, or glue, showed less blotching of spray and would require less wiping to pass inspection for poison than fruit sprayed with lead arsenate alone.

In work with the cranberry fireworm, the application of a miscible oil resulted in nearly complete destruction of the eggs with no serious harm to the plant. A brief reference is made to materials that can be used as repellents to bees when applied with arsenical sprays.

Economic insects observed at Puławy and vicinity in 1919, St. Minkiewicz (*Pam. Państ. Inst. Nauk. Gosp. Wiejsk. Puławach* (*Mém. Inst. Natl. Polonais Écon. Rurale Puławy*), *1* (*1921*), *A, No. 2, pp. 141–157*).—The more important enemies of the farm, garden, and orchard observed at Puławy and in the vicinity in 1919 are briefly considered.

Experiments on the control of cruciferous oil-crop pests (*Mitt. Biol. Reichsanst. Land u. Forstw. No. 22* (*1921*), *pp. 49, figs. 3*).—Papers are here presented on Experiments in the Control of the Cabbage Flea-beetle (*Haltica oleracea* L.) and the Rape Blossom Beetle (*Meligethes aeneus* Fab.), by Börner, Blunck, and Dyckerhoff (pp. 5–41); Practical Control Work with the Rape Blossom Beetle in 1920, by Grosser (pp. 42–45); Report of the Agricultural Institute for Plant Protection at Hohenheim on the Rape Blossom Beetle Control, by Lang (pp. 45, 46); Report of the Royal Biological Institute on Experiments in the Control of Cruciferous Oil-Crop Pests in 1920, by Rabbas (pp. 47, 48); and Control Work with the Rape Blossom Beetle with Uranium Green, by A. Wolfram (pp. 48, 49).

Insects which attack food products, G. N. Wolcott (*Porto Rico Dept. Agr. and Labor Sta. Circ. 65* (*1922*), *Spanish ed., pp. 8*).—This is a brief popular account.

The distribution of Rickettsia in the tissues of insects and arachnids, E. V. Cowdry (*Jour. Expt. Med., 37* (*1923*), *No. 4, pp. 431–456, pls. 3*).—Investigations by the author here reported show that Rickettsia occasionally occur in certain species of the following groups, although these groups are not closely related phylogenetically, namely, Attidae, Trombidiidae, Argasidae, Ixodidae, Cinura, Acanthiidae, Pediculidae, Hippoboscidae, Chrysopidae, Pulicidae, and Ichneumonidae. The majority of the species which possess Rickettsia live entirely upon mammalian blood.

Cockroaches, F. Seín, jr. (*Porto Rico Dept. Agr. and Labor Sta. Circ. 64* (*1923*), *Spanish ed., pp. 3–12, figs. 9*).—This is a brief illustrated account of the cockroaches met with in Porto Rico.

A biology of the British Hemiptera-Heteroptera, E. A. Butler (*London: H. F. & G. Witherby, 1923, pp. VIII+682, pls. 7, figs. 53*).—This work is intended to supplement the textbook by Saunders, on the Hemiptera-Heteroptera of the British Islands, published in 1892. Four hundred sixty-two forms are dealt with. A bibliography of 17 pages, a list of British Hemiptera-Heteroptera systematically arranged, a list showing the seasonal distribution of the British species, an index to host plants, and an index to species and genera are included.

The life history of Euphyllura arbuti Schwarz (Hemiptera; Chermidae), G. F. Ferris and P. Hyatt (*Canad. Ent., 55* (*1923*), *No. 4, pp. 88–92, figs. 10*).—

This is a report of studies of a chermid that is a source of injury to madrone trees (*Arbutus menziesii*) in the San Francisco Bay region.

A brief history of the black fly in Cuba, its distribution and latest developments, R. HART (*Fla. State Hort. Soc. Proc., 35 (1922), pp. 89–94*).—This is a brief summary of information on *Aleurocanthus woglumi* Ashb. in Cuba.

Controlling San José scale with lubricating oil emulsion, L. HASEMAN and K. C. SULLIVAN (*Missouri Sta. Circ. 109 (1923), pp. 4, figs. 2*).—The control of the San José scale, which during the last three years has been unusually destructive in the Mississippi Valley, is said to be the most important problem that Missouri orchardists have to meet. An orchard survey made by the Plant Inspection Service during the summer of 1922 resulted in the finding that over 50 per cent of the 10,000 acres of orchards inspected in 30 of the most important fruit-producing counties was infested. Tests of the lubricating-oil emulsion used by the U. S. D. A. Bureau of Entomology in Arkansas (E. S. R., 47, p. 453) have shown that it will give almost 100 per cent kill in Missouri without any apparent signs of injury to the trees. At a strength of 2 per cent, which is recommended, lubricating-oil emulsion costs between one-third and one-half that of commercial liquid lime sulphur.

On an outbreak of Phlyctaenodes sticticalis L., F. RAMBOUSEK (*Československ. Společ. Ent., Ent. Přír., No. 10 (1922), pp. 26, figs. 14*).—A report of observations of the life history and habits of the beet webworm (*Loxostege sticticalis*) during a serious outbreak, its natural enemies, and control measures in Czechoslovakia. The pest has spread from Trebišov into all Slovakia and thence into southern Moravia, where it has caused great damage. The parasites reared from cocoons include *Apanteles* sp., *Phytodictus segmentator* Grav., *Pimpla examinator* F., *Microtachina erucarum* Rond., and *Phora rufipes* Mg.

The barrier factors in gipsy moth tree-banding material, M. T. SMULYAN (*U. S. Dept. Agr. Bul. 1142 (1923), pp. 16*).—It is thought to have been clearly demonstrated by the qualitative tests here described that the two factors (1) odor and (2) soft and semiviscid condition operate together in enabling the gipsy moth tree-banding material to halt the caterpillars in their efforts to ascend to the foliage. "The first series, in which the solid odorous bands were used, could not be considered conclusive for physical or technical reasons, but it indicated clearly that the first element, namely, odor, exercises at least a restraining influence. The second series, in which bands made of actual gipsy moth tree-banding material were used, demonstrated satisfactorily that the soft and semiviscid, or viscous, condition of the material is the basic or primary factor. The odor restrained, indeed, but when acting alone did not completely check; whatever 'dislike" or 'fear' it inspired was overcome sooner or later. . . . The caterpillars, it should be added, seemed to 'dislike' or 'fear' the odorless and nonirritating check bands in proportion as they were viscid, or 'sticky,' and they reacted to these very often, especially to the more viscid, fully as promptly as to the gipsy moth tree-banding material bands."

The strawberry tiger moth (Haploa reversa Str.), W. J. BAERG (*Arkansas Sta. Bul. 183 (1923), pp. 3–14, pls. 5, figs. 4*).—The author here presents a summary of information on *H. reversa*, which was reported in the spring of 1920 as injuring strawberry foliage in the vicinity of De Queen, Ark., and was later found fairly numerous in strawberry beds near Johnsons. The species was reported by Le Baron in 1870 as injurious to the pear tree and in 1871 by C. V. Riley as injurious to peach. The pest has recently been reported by Garman, under the name *H. lecontei*, as causing injury to apple buds in Kentucky (E. S. R., 46, p. 157). Following a brief historical account of the

species, the author reports upon studies of its specific characters, color pattern as a specific character in other insects, and the larva as a basis for determining the species, and follows with an account of its life history, economic importance, and control measures.

Deposition of eggs was first observed in an insectary on June 2, as many as 240 having been deposited in a mass by one female, while two masses of 106 and 70 eggs, respectively, were deposited by another. The incubation period of eggs, which were first deposited on June 2 was nine days. Three larvæ that hatched out June 6 were kept under observation until December 12, when the apple foliage was destroyed by frost, at which time they were not more than one-fourth grown. In nature the larvæ that appear in spring are one-half grown or larger. In 1920 the partly grown larvae were first observed feeding on the buds of apple on March 10, and they appear upon the foliage of strawberry about the same time. They continue to feed for a month or more, then spin a flimsy cocoon among some dry leaves and pupate. The author's observations in the insectary indicate that the pupal stage covers from 3 to 4 weeks.

When the pest appears in sufficient number to threaten the yield, it is thought that the application of dust mixtures containing arsenic in some form will be sufficient to hold it in check.

The dying balsam fir and spruce in Minnesota, S. A. GRAHAM (*Minn. Agr. Ext. Spec. Bul. 68 (1923), pp. 12, figs. 2*).—This is an account of the damage caused by the spruce or balsam budworm (*Tortrix fumiferana* Clem.) in northern Minnesota, where much of the balsam fir and part of the spruce is being destroyed. It is stated that at least 75 per cent of the balsam fir in the infested area will succumb to the attack of this pest. From 50 to 100 per cent of the balsam stand usually succumbs to the attack of this budworm.

Recent work on the pink bollworm, G. STOREY (*Cairo Sci. Jour., 11 (1923), No. 108, pp. 15–20*).—This is a brief summary of recent work on the pink bollworm, more than 75 papers relating to which are said to have been published during the past two years.

The peach and prune twig-miner, A. L. LOVETT (*Oregon Sta. Circ. 38 (1923), pp. 4, figs. 3*).—A brief popular summary of information on the peach twig-moth.

The fruit-tree leaf-roller in the Bitter Root Valley, W. S. REGAN (*Montana Sta. Circ. 109 (1922), pp. 13, figs. 13*).—This is a practical summary of information on *Archips argyrospila* Wlk. (*Cacoecia argyrospila*), based upon work by Thompson (E. S. R., 45, p. 855) and by Parker (E. S. R., 46, p. 156), and on investigations by the author, the results of which will be published in a forthcoming bulletin.

Revision of the North American moths of the subfamily Eucosminae of the family Olethreutidae, C. HEINRICH (*U. S. Natl. Mus. Bul. 123 (1923), pp. IV+298, pls. 59, fig. 1*).—In this revision of the subfamily Eucosminae 26 genera are recognized, of which 9 are erected. A total of 382 species and 29 varieties are recognized, of which 69 species and 9 varieties are described as new, while 6 species described have not been recognized.

Mycetophilid flies as pests of the cucumber plant in glasshouses, E. R. SPEYER (*Bul. Ent. Research, 13 (1923), No. 3, pp. 255–259, pl. 1, figs. 8*).—This is a brief account of an attack of larvae of certain "fungus-gnats" of the family Sciaridae, thought to be *Pnyxia* (*Epidapus*) *scabiei* Hop., upon the roots of indoor cucumber plants.

Observations on the oviposition of the house fly (Musca domestica L.) in Panama, L. H. DUNN (*Bul. Ent. Research, 13 (1923), No. 3, pp. 301–305*).—Observations made by the author in the Canal Zone are reported. Details of egg deposition on the days following the emergence of females are shown in

a chart which is attached. It was found that one female may deposit as many as 21 batches, or a total of 2,387 eggs, in 31 days after emergence.

A toxin-producing anaerobe isolated principally from fly larvae: Its relation to the organisms hitherto known to be causative factors in the production of botulism, I. A. BENGTSON (*Pub. Health Rpts. [U. S.], 38 (1923), No. 8, pp. 340–344*).—This is a report of studies of the anaerobe isolated from fly larvae, conducted in continuation of those previously noted (E. S. R., 47, p. 258), and of several other similar strains isolated from different sources, as well as of representatives of the American types A and B *Bacillus botulinus* and of two European strains of *B. botulinus*. The studies were conducted for the purpose of determining the relationship between various strains of *B. botulinus*, both as to cultural behavior and toxin production. They show that there are strains which are alike culturally but which produce dissimilar toxins, and that, on the other hand, there are strains which produce similar toxins but which differ culturally.

Resistance to tachinid infestation, F. ECKSTEIN (*Centbl. Bakt. [etc.], 2. Abt., 57 (1922), No. 1–3, pp. 61–69, pl. 1, figs. 3*).—The parasitism by tachinids during an outbreak of the sawfly *Lyda stellata* in a Bavarian forest district was observed to reach as high as 60 per cent, the parasitism by ichneumonids being very low. A protective adaptation observed consisted in an encapsulation by the host of the parasitic larva.

The onion maggot, A. L. LOVETT (*Oregon Sta. Circ. 37 (1923), pp. 4*).—A brief popular summary of information on the onion maggot.

Experiments with the green muscardine fungus on rhinoceros beetle larvae, G. BRYCE (*Ceylon Dept. Agr. Bul. 65 (1923), pp. 7*).—The author concludes that the green muscardine fungus is not strongly pathogenic to rhinoceros beetle larvae. Periods varying from 39 to 81 days elapsed between the time of inoculation and the development of the fungus on the larvae.

Preliminary notes on the "Kadondong" beetle, Podontia 14-punctata L., G. H. CORBETT and M. YUSOPE (*Agr. Bul. Fed. Malay States, 9 (1921), No. 3, pp. 192–200, pl. 1*).—The authors refer briefly to the literature and report observations made of this beetle, which was reported in March, 1920, for the first time defoliating the Otaheiti apple or "Kadondong" (*Spondias dulcis*).

Fungus parasites of the coffee berry beetle borer in Java, K. FRIEDERICHS and W. BALLY (*Meded. Koffiebessenboeboek Fonds [Java], No. 6, (1923), pp. 103–157, pls. 5, figs. 2*).—The authors present descriptions and report upon investigations of two fungi which may kill *Stephanoderes hampei* Ferr. (*coffeae* Hgd.), under the names *Botrytis stephanoderis* n. sp. and *Spicaria javanica* n. sp., the former being found in Java and Sumatra and the latter in east Java. That natural epidemics sufficient to eradicate the beetle even locally are not known is due, it is thought, to the rapid reproduction of the beetle.

A new apple pest, J. C. F. FRYER (*Jour. Min. Agr. [Gt. Brit.], 29 (1922), No. 8, pp. 748, 749, pl. 1*).—A new weevil, *Anthonomus cinctus* Kol. (*pyri* Boh.), not previously recorded in Great Britain, to which the name bud weevil is given to distinguish it from the blossom weevil, has appeared in and become a source of injury to the unexpanded leaf or truss buds of apple during the past two years in Kent and Norfolk.

The boll weevil: A review of the methods of control, R. E. MCDONALD (*Texas Dept. Agr. Bul. 74 (1923), pp. 21, pl. 1*).—This is a brief review of methods made use of in combating the boll weevil.

Beekeeping for beginners, C. DRIEBERG (*Ceylon Dept. Agr. Bul. 63 (1923), pp. 20, pls. 4*).—A popular guide.

A new phytophagous chalcid attacking bamboo, J. WATERSTON (*Bul. Ent. Research, 13 (1923), No. 3, pp. 307–310, figs. 2*).—Under the name *Harmolita*

aequidens, the author describes a new chalcid reared from larvae tunneling in bamboo stems in the Federated Malay States.

The type species of the genera of Chalcidoidea or chalcid flies, A. B. GAHAN and M. M. FAGAN (*U. S. Natl. Mus. Bul. 124 (1923), pp. 173*).—In the preparation of this work the authors have attempted to present a complete catalogue of all of the known generic names referred to this superfamily and an indication in every case of what is thought to be the correct genotype. The list includes a total of 1,911 generic names, inclusive of 98 emendations, or considerably over double the number listed by Ashmead[1] in 1904 in his Classification of the Chalcid Flies.

Aplastomorpha vandinei Tucker, an important parasite of Sitophilus oryza L., R. T. COTTON (*Jour. Agr. Research [U. S.], 23 (1923), No. 7, pp. 549–556, pl. 1*).—This is said to be the most effective insect enemy of the rice weevil in the United States, it being of chief economic importance as a parasite of the rice and granary weevils. It has, however, been reported as parasitic upon several other insects of economic importance, including the 4-spotted bean weevil (*Bruchus quadrimaculatus*), the cigarette beetle, *Pachymerus* sp., the "grain moth," and miscellaneous forest galls, and has also been reared by the author from the broad-nosed grain weevil (*Caulophilus latinasus* Say). After reviewing the history and synonymy of this insect, the author considers its economic importance, presents technical descriptions of the species, describes methods used in the study of the parasite, and reports studies of its life history and habits.

On the occurrence of leaf-eating sawflies on cereals in Britain, A. ROEBUCK (*Bul. Ent. Research, 13 (1923), No. 3, pp. 267–269, figs. 3*).—Two species of leaf-eating sawflies responsible for damage to cereals reared in 1920 and 1921 were determined to be *Pachynematus clitellus* Lep. and *Dolerus haematodis* Klug.

Spiders, C. WARBURTON (*Cambridge: Univ. Press, 1921, pp. X+136, figs. 14*).—This is a popular account.

Rocky Mountain spotted fever: Infectivity of fasting and recently fed ticks, R. R. SPENCER and R. B. PARKER (*Pub. Health Rpts. [U. S.], 38 (1923), No. 8, pp. 333–339*).—The investigations here reported upon indicate that the ingestion of fresh blood is necessary to reactivate the virus in the unfed infected ticks which appear in the spring. Tests made with the rabbit tick (*Haemaphysalis leporis-palustris* Pack.), the transmission of the virus by which was first demonstrated by Parker in 1921, gave similar results.

On some strongylid larvae in the horse, especially those of Cylicostomum J. E. W. IHLE and G. J. VAN OORDT (*Ann. Trop. Med. and Parasitol., 17 (1923), No. 1, pp. 31–45, figs. 9*).—This is a report of observations made by the authors at Utrecht, Netherlands. All the larvæ observed were found in the mucosa of the large intestine with the exception of a small number free in the lumen of the intestine.

FOODS—HUMAN NUTRITION.

Nutrition laboratory, F. G. BENEDICT (*Carnegie Inst. Wash. Yearbook 21 (1922), pp. 256–265*).—This annual report of the nutrition laboratory of the Carnegie Institution (E. S. R., 47, p. 164) includes a brief outline of the researches carried on in various institutions in cooperation with this laboratory, a list of the cooperative and visiting investigators, brief descriptions of the investigations in progress, and abstracts of the publications of the past year, many of which have been noted previously from the original sources.

[1] Mem. Carnegie Mus., 1 (1904), No. 4, pp. XI + 551.

Indiana flour (*Indiana Sta. Circ. 109 (1923), pp. 15, figs. 9*).—Information is summarized regarding the use of flour from Indiana wheat, and recipes and directions are given for making bread and other foods, also directions for scoring bread. According to the circular, "the flour produced in Indiana can be used to make good, highly nutritious bread, excellent pastry, rolls, and hot biscuits."

In studying the problem, "flours from mills representing different agricultural centers of Indiana were used in a series of experiments in the making of yeast bread under home conditions. The yeasts used were compressed yeast, dry yeast, liquid yeast, and some 'starters' which in different localities go by different names. The liquids used were water, potato water, and a combination of milk and water.

"With good yeast, proper handling, and the use of correct temperatures, the flours used yielded loaves of bread which were good as to shape, color, texture, and flavor. The proportions of ingredients [in the recipes given] were found satisfactory for the flour used."

Weight and height as an index of nutrition, T. Clark, E. Sydenstricker, and S. D. Collins (*Pub. Health Rpts. [U. S.], 38 (1923), No. 2, pp. 39–58, figs. 4*).—This paper reports the results of a statistical analysis of the weight and height measurements of 9,973 white children from 6 to 16 years of age of native parentage in different parts of the country considered in relation to their state of nutrition as determined independently upon the basis of clinical evidence. The children, after a physical examination, were graded according to nutritional status into 4 groups—excellent, good, fair, and poor. In the comparison with weight-height measurements the first 2 and the last 2 groups were combined as satisfactory and unsatisfactory. Tables and graphs are given showing the mean weight, mean standing height, mean sitting height, and mean weight-height index of these two nutrition groups for each sex and age, and the percentage distributions in 2-year groups of the children in the two nutrition grades according to weight, standing height, and sitting height.

On the average the children classified as of satisfactory nutrition were larger in weight and in standing or sitting height than the children of unsatisfactory nutrition. A large proportion of the children in the first group, however, weighed less than some of the unsatisfactory group and a considerable proportion less than the average weight of the unsatisfactory group. Still less difference could be noted in the relation between sitting and standing height and nutritional status, although the heights tended to be slightly less in the unsatisfactory than in the satisfactory group, and this tendency appeared to increase with age.

The percentage of children in the unsatisfactory group, as judged by clinical evidence, varied with age, increasing in the 6- to 8-year groups and decreasing in succeeding groups, with no significant difference between boys and girls. The percentage of children who were as much as 10 per cent underweight or 20 per cent or more overweight, as judged by Wood's tables of weight for sex, age, and height, increased with age through the fourteenth year for girls and the sixteenth year for boys. The girls showed a consistently higher percentage of underweight and overweight than the boys.

The authors conclude that "if average weight is to be used as even a rough index to nutrition, it seems that the percentage deviation allowed for normal variation from the average should vary for different sexes rather than be a constant 7 or 10 per cent, as usually used in school health work."

The influence of fat and carbohydrate on the nitrogen distribution in the urine, E. P. Cathcart (*Biochem. Jour., 16 (1922), No. 6, pp. 747–753*).—This is an extension of a previous investigation (E. S. R., 22, p. 169). In the

present study the fat diet consisted entirely of pure olive oil emulsified jus before taking with the addition of a small amount of potassium carbonate. I two experimental periods of 3 days each, 323 gm. of the oil was consumed daily following which the oil was gradually reduced and chemically pure dextros added to the extent of 30, 60, 100, and 150 gm., respectively, for each experi mental period of 3 days. The daily output of nitrogen during the entire perio was determined as total, urea, ammonia, total creatinin, and uric acid nitrogen and the results calculated further in percentages of total nitrogen.

In general the output of total, urea, and ammonia nitrogen tended to rise o the fat diet and to fall on the addition of carbohydrate to the diet. Con versely the uric acid output decreased on the fat diet and increased with in creasing amounts of carbohydrate. The total creatinin output appeared to b unaffected by the changes in diet.

In discussing the bearing of these results on the question of the mutua replacement of carbohydrates and fats, the author states his views as follows "It is undoubtedly true that within limits fat and carbohydrate may replac one another in the diet, and it is obvious that in the average diet such a arrangement is automatically adopted. The statement of the case in the form of a general isodynamic law is isimply untenable. At present the evidence i clear and convincing in support of the statement that it is impossible to replac carbohydrate completely by fat, but so far the evidence available in support o the view that fat as such is a necessary constituent of a diet is scanty an unsatisfactory."

Chronic intoxication by small quantities of cadmium chlorid in the die C. O. Johns, A. J. Finks, and C. L. Alsberg (*Jour. Pharmacol. and Expt. Ther 21 (1923), No. 1, pp. 59–64, figs. 3*).—The investigation reported in this pape was undertaken at the Bureau of Chemistry, U. S. D. A., as the result of suggestion made during the World War of substituting cadmium for tin i solder for food containers. To determine the possible toxic effect of sma amounts of cadmium ingested with food, observations were made on the growt of young white rats on an adequate diet in which had been incorporated var ous concentrations of cadmium chlorid calculated as the metal and rangin from 62.5 to 1,000 parts per million.

When the concentration of cadmium was 1,000, 500, or 250 parts per mi lion, very little or no growth occurred and death resulted in about 30, 14 and 180 days, respectively. On diets containing 125 parts of cadmium pe million the initial rate of growth was about normal, but the male rats died i about 50 days and the females at a considerably later period. On diets co taining 62.5 parts per million normal growth occurred, with no death Throughout the various experiments the food intake varied inversely with th amount of cadmium present. On the lowest amount of cadmium the food intak averaged 9 gm. daily, with cadmium 0.56 gm., while on the diet furnishin 1,000 parts of cadmium per million the average food intake was only 3 gr and that of cadmium 3 mg. The observations reported thus furnish no evidenc as to whether or not cadmium has any harmful effect other than the redu tion of the food intake below the minimum for maintenance and growth. Th normal results obtained with the smallest dose indicate, however, that the is apparently no accumulative poisonous action of this metal.

The occurrence of copper and zinc in certain marine animals, H. V Severy (*Jour. Biol. Chem., 55 (1923), No. 1, pp. 79–92*).—Determinations copper by the method of Rose and Bodansky (E. S. R., 44, p. 556) and of zi by the method of Bodansky (E. S. R., 46, p. 260) were made on 16 differe marine animals of the Pacific coast. Specimens of sea water from near th shore and 1 mile out were also analyzed for zinc and copper.

Copper was found in some portions of all the specimens examined with the exception of the clam and whale. It was not present in the internal shell of the cryptochiton and the blood of the sea lion, and was present in traces only in the mussel shells and the liver and spleen of the sea lion. The extreme variations were from 0.564 mg. per kilogram in the sea lion to 13.07 mg. per kilogram in the shrimp, averaging 0.497 mg. per kilogram.

Zinc was found in all the specimens examined, varying in amount from 2.11 mg. in sea urchins to 64.97 in oysters, and averaging 4.25 mg. per kilogram. A comparison of the results obtained for oysters, clams, shrimps, and crabs with those reported by Rose and Bodansky for eastern specimens showed the greatest disparity in both the copper and the zinc content of the oyster, the copper in the eastern oyster averaging nearly seven times and the zinc over six times that of the California oyster.

An attempt to determine the relative distribution of the two metals in different parts of the organism was made with the cryptochiton. The largest amount of copper was found in the blood, followed by the mantle, muscle, and digestive organs. With zinc the order was mantle, muscle, digestive organs, and blood.

It is concluded that copper is present in the lower forms of sea animals as an oxygen carrier in place of iron, and that zinc "may be present as an aid to enzymic action in a manner not understood."

Food essentials, C. H. HUNT (*Ohio Sta. Mo. Bul., 8 (1923), No. 1–2, pp. 1–7, figs. 2*).—This is a brief discussion of the sources and function of vitamins A, B, and C, and of the antirachitic vitamin of cod liver oil which is designated in this paper as vitamin D. It is stated that, from tests carried out at the station, goat's milk appears to be richer than cow's milk in vitamin C.

The vitamin content of certain proprietary preparations, K. H. COWARD and A. J. CLARK (*Brit. Med. Jour., No. 3236 (1923), pp. 13–15, fig. 1*).—Six proprietary preparations advertised as containing vitamins (most of them claiming to contain all three) were tested for the presence of vitamins A and B by the usual feeding experiments with young rats. The animals were kept on a basal diet lacking the vitamin in question until growth ceased, and then a known amount of the substance was fed each day before the rest of the basal diet was given, the aim being to determine the minimal amount of the substance furnishing sufficient vitamin to produce growth.

The doses of the various preparations required to produce normal growth when fed as the sole source of vitamins A and B, respectively, were as follows: Metagen 0.3 and 0.3 gm., Roboleine 1 and 0.5 gm., Virol 0.5 and 0.5 gm., Vitmar 0.5 and 0.5 gm., and Mellin's Food 0.1 and 1 gm. Another preparation, Maltoline, failed to show the presence of vitamin A, but in 1-gm. amounts furnished sufficient vitamin B. For purposes of comparison, the amounts of certain common foodstuffs required to furnish sufficient vitamins A and B for normal growth in young rats are given as follows: For vitamin A, milk (summer feed) 2 to 5 cc., butter (summer feed), 0.2 gm., and cod liver oil 0.003 gm., and for vitamin B milk 8 cc., wheat germ 0.2 gm., and yeast 0.2 gm.

A further comparison of the relative value of these proprietary preparations and milk as sources of vitamins is given in estimations of the amount of milk which provides the same quantity of the vitamin as contained in the recommended daily adult dose of the proprietary product. These values are for Metagen 1 oz. of milk to furnish the equivalent amount of vitamin A and 1.5 oz. that of vitamin B, for Maltoline 8 and 13 oz., for Roboleine 5.3 and 17 oz., for Virol 11 and 17 oz., and for Vitmar 14 and 23 oz., respectively. Since Mellin's Food is given with milk, it is considered that in some cases it may be of value as a supplement to milk of low vitamin content. In regard to the other prepa-

rations, it is noted that none of them furnishes in the total daily adult dose as much as one-tenth of the vitamin A content of a teaspoonful of cod liver oil.

The authors conclude that their "experiments confirm what other workers on vitamins have emphasized, namely, that under normal conditions of life an adequate supply of vitamins can be easily insured by including in the diet a suitable amount of 'protective foods,' such as milk, butter, green vegetables, and fruit, and that no advantage is to be gained by trying to obtain these substances in the form of drugs."

A note on the storage of vitamin A in the liver of the rat, K. H. COWARD, J. L. LUSH, and M. G. PALMER (*Lancet [London], 1923, I, No. 3, pp. 124, 125, figs. 4*).—The influence of diet on the storage of vitamin A in the liver was studied on rats, using the usual methods of feeding the test animals a diet deficient in vitamin A until growth had ceased and then feeding as the sole source of this vitamin the livers of other rats. These in one group had been kept on a diet deficient in vitamin A for about 14 days after the weight had remained steady at from 110 to 120 gm., and in another group had been fed for the same length of time on a diet rich in vitamin A. In the first series the fresh liver was fed to different groups of rats in doses of 0.02, 0.1, 0.5, 0.7, and 1 gm., respectively, and in the second in doses of 0.1, 0.3, and 0.5 gm., respectively.

In the first series no growth was secured on amounts under 1 gm. The animals receiving this amount began to grow and gradually returned to normal condition. In the second series good growth was secured on 0.1 gm., and it is thought that growth might also have resulted from even smaller doses.

These findings are considered of significance not only in showing that the vitamin A content of the liver of the rat varies with the concentration of this vitamin in the diet, but also in indicating that for a considerable time at least after growth has ceased there still remains an appreciable amount of vitamin A in the liver. An appended note states that in a later test carried out on fresh livers of rats which had been kept on the deficient diet until a definite decline in weight had set in, 1-gm. doses completely failed to restore growth in the test animals, showing that the vitamin had been still further exhausted.

The presence of the antineuritic and antiscorbutic vitamins in urine, N. VAN DER WALLE (*Biochem. Jour., 16 (1922), No. 6, pp. 713–726, figs. 5*).—Evidence along various lines is reported leading to the conclusion that normal urine contains the antineuritic but not the antiscorbutic vitamin.

Five cc. of urine concentrated by evaporation at 45° C. caused an improvement in the symptoms of polyneuritis in pigeons and postponed the appearance of polyneuritis when administered as a prophylactic in connection with polished rice. Urine dried at 37° for 16 hours was still active, but became inactive on heating at 130° for 1 hour. The ash of urine was likewise inactive. On shaking urine with purified animal charcoal, the charcoal became activated and the urine inactivated. That the curative power of urine was not due to its content of inorganic salts was shown by the fact that charcoal shaken with a solution of the salts as present in urine was inactive. Yeast cultivated in urine to which 5 per cent of glucose had been added had marked curative properties.

The urine of a dog on a diet containing antineuritic vitamin was as effective as human urine, but after the dog had been fed a diet deficient in this vitamin the urine no longer had a curative effect.

Fresh normal urine or dried urine was also shown to have a curative action on polyneuritis in fowls.

In none of the guinea pig tests was any evidence obtained of the presence of vitamin C in fresh urine.

The antineuritic action of histamin on pigeons nourished on polished rice, W. Koskowski (*Arch. Internatl. Pharmacodyn. et Thér., 26 (1922), No. 5–6, pp. 367–373, figs. 2*).—The author refers to the theory of Lumière that vitamins serve only to stimulate the glands of external secretion and maintain the tone of the digestive apparatus (E. S. R., 45, p. 868), and states that if this be true any substance capable of stimulating the digestive glands would retard or even prevent the symptoms caused by lack of this vitamin. To test this hypothesis, seven pigeons on a diet of polished rice received daily injections of 0.0004 gm. of histamin in 5 cc. of physiological salt solution, four beginning at the first day of the experiment, the fifth at the tenth, the sixth at the sixteenth, and the seventh at the twentieth day. The others were kept as controls on polished rice alone.

In both groups the progress could be divided into three periods, a preliminary period of from 7 to 8 days during which the weight remained about constant, a second period characterized by progressive loss in weight, and a third period commencing 3 or 4 days before death and characterized by an absolute loss of appetite, and in the controls by paralytic seizures. Although the amount of rice eaten daily by the pigeons receiving the histamin was greater than that of the controls, the progressive loss in weight was also greater. The duration of life was about the same. On autopsy those receiving histamin gave evidence of having digested the rice. The stomach was either empty or filled with an acid liquid, and the intestines empty or filled with a fluid mass of greenish-yellow color. The characteristic nerve symptoms of polyneuritis were absent from the pigeons receiving histamin except in the case of those receiving it quite late in the experiment. Injections of histamin in pigeons already presenting paralytic symptoms were without effect.

The author concludes that the condition induced in pigeons on polished rice is not caused by the lack of digestive juices, but by the absence in the polished rice of a plastic substance indispensable for the building up of the tissues.

Are the phenomena of avitaminosis modified by the administration of histamin in the case of the white rat? L. Boyenval (*Arch. Internatl. Pharmacodyn. et Thér., 26 (1922), No. 5–6, pp. 359–365, figs. 3*).—Studies similar to those reported above for pigeons have been conducted on white rats with similar results. The injection of histamin had no effect upon the general condition of malnutrition of the rats fed polished rice and did not prolong life. None of the animals receiving histamin, however, showed the nerve symptoms which ordinarily precede the death of rats on polished rice. That histamin had exercised its function of stimulating the digestive glands was shown on autopsy. These results are thought to confirm the conclusions of the above study.

On the vitamin D, T. B. Heaton (*Biochem. Jour., 16 (1922), No. 6, pp. 800–808, fig. 1*).—In order to determine the relationship between the vitamin responsible for the activation of yeast, the antineuritic vitamin, and the growth-promoting vitamin B, a study has been made of the distribution of the yeast-activating vitamin in the organs of normal and polyneuritic pigeons and of normal rats and rats suffering from a lack of vitamin B. The method adopted for the measurement of the yeast-activating substance consisted in determining the rate of fermentation, as indicated by the evolution of carbon dioxid, of a known quantity of brewers' yeast in a standard medium to which had been added a definite amount of an extract of the substance to be tested. The medium employed was Nägeli's solution with the ammonium nitrate omitted. The amount of yeast added was a quantity insufficient in itself to produce any fermentation in this medium in 24 hours. The fermentation caused by a 2 per cent extract of dried yeast was taken as the basis of comparison with the fer-

mentation caused by 2 per cent aqueous extracts of the various organs air-dried at 33° C. The amount of dried yeast equivalent in activating power to a unit weight of the material investigated is called the yeast equivalent of the substance.

As thus calculated, the average yeast equivalents of various organs of 3 normal pigeons and of 7 pigeons in the last stages of polyneuritis were, respectively, as follows: Cerebrum 0.8 and 0.7, cerebellum 0.8 and 0.75, liver 0.9 and 0.9, kidney 0.85 and 0.8, heart 0.8 and 0.8, and muscle 0.7 and 0.8. These results show that the activity of the organs of the polyneuritic pigeons is only slightly less than that of normal pigeons, and that the distribution of the activating amount in the various tissues is not the same as that of the antineuritic vitamin.

Similar experiments with tissue material from 3 rats on a normal diet, 3 which had been in a vitamin B-free diet for 6 weeks, and 5 on the same deficient diet until moribund are reported. The average yeast equivalents for the three classes were, respectively, as follows: Brain 0.9, 0.6, and 0.55; liver 0.8, 0.7, and 0.55; kidney 1, 0.8, and 0.6; and heart 0.75, 0.5, and 0.4. The decreasing values with the long-continued deficient diet indicate that rats suffering from vitamin B deficiency are deprived of some substance which is still present in polyneuritic pigeons. These results are thought to confirm the conclusions of Funk and Dubin (E. S. R., 46, p. 759) "that there are two water-soluble vitamins present in yeast. It is the absence of one of these, vitamin B, which causes polyneuritis in birds, while the other, which these authors call vitamin D, is the 'bios' of Wildiers necessary to the activity of low concentrations of yeast cells. Both of them are necessary for the proper growth of rats. The prevailing uncertainty as to the identity of the antineuritic and growth-promoting vitamins is due, therefore, to the fact that the latter includes the antineuritic substance, but contains also another essential factor, the vitamin D."

A guinea pig epizootic associated with dietary deficiency, A. T. Glenny and K. Allen (*Lancet [London], 1921, II, No. 22, p. 1109*).—A brief abstract is given of an investigation of the cause of an epizootic in a laboratory stock of guinea pigs resulting in a death rate of from 15 to 20 per cent a week. The deaths in the first 4 weeks were mostly from typical Gaertner infection and in the next 2 weeks from bronchial pneumonia, caused by *Bacillus fecalis alkaligenes*. These infections appeared to be traceable to the substitution of mangels for the green feed usually given in addition to the basal diet of bran, oats, and hay. When the mangels were replaced by cabbage, grass, or alfalfa, the epizootic was quickly checked, although no precautions were taken to prevent the infection of the healthy animals.

The food value of mangels and the effects of deficiency of vitamin A on guinea pigs, E. Boock and J. Trevan (*Biochem. Jour., 16 (1922), No. 6, pp. 780–791, figs. 10*).—A report is given of an investigation of the deficiencies for guinea pigs in the diet of bran, oats, mangels, and water, which was apparently responsible for the epizootic noted above. This diet is shown to be deficient in calcium, vitamin A, and protein, the latter in quantity, quality, or both. By supplementing this diet with caseinogen, a suitable salt mixture, and paper, all deficiencies except lack of vitamin A were overcome. This deficiency was indicated by a loss in weight and the development of keratomalacia, the first appearance of which was a clouding of the cornea. The administration of 1 cc. of cod-liver oil to animals in this condition resulted in an almost immediate increase in weight and resumption of the normal rate of growth, with a complete disappearance of eye trouble in about a week. The deficiency of mangels in vitamin A was also confirmed by feeding experiments on rats. That mangels

are not lacking in vitamin C was shown by the fact that none of the experimental animals developed scurvy.

In discussing further the need of guinea pigs for vitamins and calcium, attention is called to the rapidity with which the effect of the absence of calcium may be noted in guinea pigs. On diets containing inadequate calcium guinea pigs lose weight in a few days, while vitamin A deficiency is not discernible for 40 or 50 days. In the author's experience the effect of deprivation of vitamin A is obtained with more regularity in guinea pigs than in rats.

The present status of experimental rickets, N. SIMMONDS (*Jour. Home Econ., 14 (1922), No. 12, pp. 601–611*).—This paper consists of a review of the literature on experimental rickets, followed by a brief discussion of recent investigations on this subject, particularly those conducted by McCollum and the author, with other collaborators, and which have been noted from the original sources.

Observations and reflections on the etiology of pellagra, J. W. JOBLING and L. ARNOLD (*Jour. Amer. Med. Assoc., 80 (1923), No. 6, pp. 365–368, figs. 3*).—The authors suggest the possibility that "pellagra may be due to a photodynamic substance produced by an organism located in the intestinal tract. The observations supporting the low protein theory may be readily explained by the assumption that this hypothetic organism can produce the light-sensitizing substance only when growing in a favorable medium consisting of an excess of carbohydrates. Such a theory would explain not only the skin manifestations of the disease but also the results obtained with a high protein diet and the epidemiologic observations made by ourselves and others. It would also explain why healthy individuals with a normal diet failed to develop the disease when fed with infected material."

Observations which tend to support this hypothesis were made on a group of 24 pellagra cases in Memphis, Tenn., in 1921 and 1922 and on 1 case in New York City in 1921. The examination consisted principally in attempts to isolate photodynamic producing organisms from the intestinal tracts of these patients. For this purpose the medium used by Currie for studying the production of citric acid by fungi was employed (E. S. R., 37, p 613). This medium was found to be unsuitable for the growth of the common intestinal bacteria but excellent for fungi. The seedings on this medium were transferred to test tubes containing the same medium, to which had been added 3 per cent of potassium iodid, 1 per cent of starch, and 2 per cent of agar. In this mixture a bright blue color develops in the light in the presence of photodynamic substances. Organisms thus identified were then transferred to a fluid medium containing the same constituents, incubated at 30° C. for 2 or 3 weeks, and then examined for fluorescence and for photodynamic action.

Following this technique, strains of fungi producing fluorescent substances were isolated from the feces from 9 acute cases of pellagra (including the New York case), from 1 of 6 subacute cases, and from 2 of 23 so-called chronic cases, some of which had not shown any symptoms of the disease for more than a year. The feces of 50 nonpellagrous persons in Nashville and Memphis and a number in New York were examined with negative results.

The fungus is thought to belong to the *Aspergillus glaucus-repens* group. After it has been grown for about 2 weeks in the fluid medium the medium becomes light brown in color and strongly acid in reaction. On rendering the medium slightly alkaline it becomes strongly fluorescent, and occasionally a red pigment is produced. The fluorescent substance can be extracted from the medium in either the acid or alkaline state by ether or ethyl acetate, and subsequently removed from the solvent by weak alkalis, yielding a mark-

edly fluorescent solution. The photodynamic action of an ether extract from which the ether had been removed by evaporation was tested by the potassium iodid starch test and by injection into mice. The inoculated mice, on exposure to light, soon developed edema and reddening of the ears and swelling and edema of the eyelids. If the inoculations were continued daily, with repeated exposure to light, the ears became gangrenous and sloughed off, the tails grew rough and scaly, and the hair fell out. In some cases death resulted soon after exposure to light. Attempts to infect the animals by feeding were unsuccessful.

While these results are considered most suggestive, it is emphasized that before a claim can be made that the cause of pellagra has been demonstrated, it must be shown that the organism is present in the majority of a large number of pellagra cases and absent in nonpellagrous individuals.

ANIMAL PRODUCTION.

Temperature and other factors affecting the quality of silage, A. Amos and G. Williams (*Jour. Agr. Sci.* [*England*], *12* (*1922*), *No. 4, pp. 323–336*).—After reviewing previous works dealing with the effect of temperature of fermentation on the quality of silage produced, the authors report the results of observations on farms and of experiments at the School of Agriculture, Cambridge University, from 1917 to 1921, inclusive.

Each year at Cambridge tower silos were filled with oats and tares under different conditions and at different stages of maturity, and maximum thermometers in metal tubes were placed at various depths in the silos. From these observations and experiments it was concluded that the silage produced from a crop may be of five types, varying according to the conditions of ensiling. (1) Sweet, dark-brown silage produced when the temperature of fermentation rises above 45 to 50° C. (113 to 122° F.). This silage is dark brown in color, has a sweet, pleasant smell, and is readily eaten by stock, but a large part of its food value has been lost by excessive heating. (2) Acid light-brown or yellow-brown silage produced from plants when moderately mature at cutting time which are allowed to wilt until the moisture content approximates 70 per cent. The maximum temperature of fermentaion varies from 30 to 37°. (3) Green, fruity silage is produced from crops cut in an immature stage. The temperature of fermentation of this silage varies from 22 to 34°. The color is green, and the odor is neither sweet nor sour, but it is very juicy, and soluble food material is inclined to drain away with the juice. (4) Sour silage is produced from an immature crop or after a crop has been cut and then saturated with rain, especially after it is partially rotted at the base. Sour silage is dark brown or olive brown in color, with an unpleasant odor, possibly due to butyric acid, and it is rather unpalatable. (5) Musty silage seems to result when the crop has been allowed to get too dry for ensiling, and small centers of mold which generate ammonia may develop. The first three types of silage have pleasant odors and are readily eaten by stock, but the last two types are more or less unpalatable.

An investigation into the changes which occur during the ensilage of oats and tares, A. Amos and H. E. Woodman (*Jour. Agr. Sci.* [*England*], *12* (*1922*), *No. 4, pp. 337–362*).—To study the effect on the composition and loss of nutrients of silage, 8 samples of oats and tares were collected at different periods after cutting. Chemical analyses of the fresh materials were made, and the samples were placed in bags and put either in small experimental silos or in a large silo with maximum thermometers near each to determine the maximum fermentation temperature.

The oats and tares were cut when the oats were well past the flower stage, some being in milk, and when the tares were in full flower with some small pods. Samples 1, 2, and 3 were put in the silo immediately after cutting, whereas 4, 5, and 6 were allowed to wilt in the field for 24, 24, and 6 hours, respectively. Samples 7 and 8 were allowed to wilt 96 hours, near the end of which period it rained, but none of the material had rotted at the time of ensiling.

The highest fermentation temperature of all samples put in the silo within 24 hours after cutting varied from 22.5 to 24.5° C., except sample 6, which reached a temperature of 34.5°. The temperature of sample 7 was 32.5° and that of sample 8, 39°.

Samples 1, 2, and 3 ran somewhat higher in moisture content than the others, containing 76.53 per cent when fresh and from 69.3 to 76.65 per cent after ensiling. In general the loss of dry matter was also greater, varying from 11.4 to 13.4 per cent. The moisture content of samples 4 to 8 varied from 62.24 to 67.4 per cent when fresh and from 62.06 to 70.07 after ensiling. The loss of dry matter in samples 4 to 7 varied from 7.2 to 10 per cent. In sample 8, where some spoilage occurred, the loss was higher, running to 16.5 per cent.

The freshly ensiled material produced a distinctly fruity silage, whereas that which was cut for 24 hours lacked this character but was distinctly acid. The silage made from the fresh cut crop was of the most desirable type, but a distinct loss of nutrients occurred because of the juice running out. Through fermentation in this silage about 50 per cent of the true protein was split up into amids. In the moderately wilted silage less dry matter was lost, and approximately 30 per cent of the protein was split into amids. The silage produced from material wilted 96 hours was not of good quality. It was moldy and there was a considerable loss of nutrients by molding, and about 18 in. on the top was spoiled.

The ensiling process seems to result in a breaking down of the cellulose, producing a gain of the nitrogen-free extract and a decrease in the fiber. The digestibility of the crude protein showed a slight decrease.

The mesquite (Prosopis juliflora).—A famine fodder for the Karoo, W. R. Brown (*Union So. Africa Dept. Agr. Jour., 6 (1923), No. 1, pp. 62–67, figs. 4*).—The mesquite bean is recommended as famine fodder for Karoo, Union of South Africa. It is very hardy, and sheep like the beans, but they will not eat the foliage.

Nutritive value of wheat [with the addition of minerals], J. L. St. John (*Washington Col. Sta. Bul. 175 (1922), p. 15*).—In studying the need for inorganic elements in a wheat ration, it has been found that the optimum amount of sodium lies between 0.3 and 0.5 per cent. Considering growth, reproduction, and general condition, 0.35 per cent seemed to give the best results. No sodium or over 1 per cent in the ration gave very unsatisfactory results, whereas the proper amount allowed a more economical usage of feed. Incomplete experiments have also indicated that it is necessary to add some chlorin to the wheat ration. Preliminary results which have been obtained indicate that it may be possible to replace the sodium by potassium.

Yellow v. white maize as food for stock, H. Wenholz (*Agr. Gaz. N. S. Wales, 33 (1922), No. 12, pp. 851–854*).—It is stated that the general preference of feeders for yellow corn instead of white corn has now been explained by the difference in vitamin content. A review is given of the experiments of Steenbock on this subject.

Vitamin in agriculture, J. Golding (*Univ. Col., Reading, Bul. 32 (1923), pp. 7*).—This is a brief review of the present knowledge of vitamins, with special reference to their importance in live-stock feeding.

The mechanism of Mendelian heredity, T. H. MORGAN, A. H. STURTEVANT, H. J. MULLER, and C. B. BRIDGES (*New York: Henry Holt & Co., 1923,* [2.] *ed., rev., pp. XIV+357, pl. 1, figs. 92*).—This is a revised and enlarged edition of the book previously noted (E. S. R., 33, p. 869). New chapters on variation in the protozoa and mutations of Oenothera have been added. The chapter on selection has been largely rewritten, and much new material has been added to the chapter on sex inheritance.

The function of Mendelian genes, J. S. HUXLEY (*Nature* [*London*], *111* (*1923*), *No. 2783, pp. 286, 287*).—Attention is called to the use of the word gene as a determiner of heredity, and to the fact that this is not synonymous with mutant gene, as seems to be the use which is given to it by certain authors.

The temperature coefficient of a heterozygote with an expression for the value of a germinal difference in terms of an environmental one, C. ZELENY (*Biol. Bul. Mar. Biol. Lab. Woods Hole, 44* (*1923*), *No. 3, pp. 105–112, figs. 3*).—The average increase per degree in temperature in the ommatidial number in heterozygous full-eye, ultra-bar Drosophilia has been found to be 7.7 per cent between 30 and 15° C. (86 and 59° F.) and 8.9 per cent between 27 and 15°. These values are very similar to 8 and 7.6 per cent as found by Krafka (E. S. R., 48, p. 368) for homozygous ultra bar, but decidedly different from 2.5, which Karrer has found for homozygous full eye (unpublished). Constants have been calculated on a logarithmic scale for expressing the relation of the genetic and temperature factors in determining ommatidial number.

On the offspring of two sires in one litter of rabbits, S. KOPEĆ (*Pam. Państ. Inst. Nauk. Gosp. Wiejsk. Puławach* (*Mém. Inst. Natl. Polonais Écon. Rurale Puławy*), *2* (*1922*), *A, No. 2, pp. 214–235, fig. 1*).—In experiments conducted by the division of experimental morphology of animals in the Polish Institute of Agricultural Research at Puławy to determine the possible effects of fetuses sired by two different males on each other, 18 Himalayan does were mated with both Himalayan and Silver bucks. Three of the litters produced showed distinctly that some of the offspring were sired by each buck. The proportions in the three litters were 4 Himalayan to 2 hybrids, 3 Himalayan to 3 hybrids, and 2 Himalayan to 3 hybrids. Previous to these matings the same does had produced pure Himalayan offspring, and on other occasions crossbred offspring on which accurate data were kept as to size, color, and other characters.

The rabbits produced by the double matings were exactly like those sired by the same sire alone, and no effects from the other fetuses sired by the different bucks were discernible in color pattern or rate of development of the colors. The F_2s produced by these offspring were as would be expected from ordinary matings. The only possible influence of one fetus upon another from a different sire was in the size of the offspring at birth. The crossbreds were naturally larger than the purebreds, and in these matings it was found that the purebreds sibbed with crossbreds were somewhat larger. It was assumed that this influence might have been due to substances secreted by the crossbred fetuses into the blood of the dam which stimulated the pure Himalayans to grow larger than normal while in utero.

The average weights of the offspring by the different matings were as follows: Himalayan ♀ × Himalayan ♂ 32.54±0.415 gm., Himalayan ♀ × Silver ♂ 38.66 ± 0.514, Himalayan offspring of Himalayan ♀ mated with Himalayan ♂ and Silver ♂ simultaneously 36.3 ± 0.811, and hybrid offspring of Himalayan ♀ mated with Himalayan ♂ and Silver ♂ 45.57 ± 1.176. The difference in size was not inherited by the second generation offspring, data for which are also given.

Canadian National Live Stock Records, 1922.—Report of record committee to record board and record associations, J. E. BRETHOUR ET AL. (*Canad. Natl. Live Stock Rec. Rpt., 1922, pp. 107*).—This consists of a record of the recognized Canadian purebred live stock associations, with lists of the purebred animals which have been imported during the year.

Winter steer feeding, 1921–22, J. H. SKINNER and F. G. KING (*Indiana Sta. Bul. 265 (1922), pp. 3–23*).—To study the relative value of rations containing different amounts of corn, the value of cottonseed meal in rations containing corn silage for fattening steers, and to determine the relative cost of production of light and heavy cattle, 5 lots of 10 950-lb. steers (lots 1 to 4 and 7) and 2 lots of 10 770-lb. steers (lots 5 and 6) were selected and fed 140 days in the case of the heavy cattle and 210 days for the lighter cattle on the following rations: Lot 1 cottonseed meal, corn silage, and clover hay, with shelled corn during the last 70 days; lot 2 cottonseed meal, corn silage, and clover hay; lot 3 cottonseed meal, corn silage, clover hay, and one-half feed shelled corn; lot 4 cottonseed meal, corn silage, clover hay, and full feed shelled corn; lot 5 corn silage and clover hay for 80 days and full feed of shelled corn thereafter; lot 6 corn silage, clover hay, and cottonseed meal for 80 days and full feed of shelled corn thereafter; and lot 7 corn silage, clover hay, and shelled corn. The cottonseed meal was fed at the rate of 2.5 lbs. per day per 1,000 lbs. live weight. Different numbers of hogs followed the cattle according to the amount of corn that was being fed. The following table gives a summary of the results of the test:

Summary of steer feeding test.

Lot.	Average initial weight.	Average daily gain.	Feed consumed per pound of gain.				Selling price.	Profit per steer.	
			Shelled corn.	Cottonseed meal.	Corn silage.	Clover hay.		Not including pork.	Including pork.
	Lbs.	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*			
1	946	2.55	2.67	0.99	13.32	1.40	$7.50	$9.13	$13.71
2	949	2.11	.....	1.20	20.16	1.95	7.20	6.14	6.14
3	951	2.24	2.83	1.12	15.77	1.59	7.45	5.87	9.93
4	948	2.61	4.90	.97	10.46	1.16	7.60	7.10	12.67
5	773	2.25	3.54	.97	12.63	1.53	8.70	17.03	25.04
6	690	1.88	4.45	.....	15.66	1.88	8.20	14.39	22.56
7	948	2.25	5.734	.....	12.23	1.43	7.45	9.80	15.42

Lots 1 to 4 were used in comparing the relative value of different amounts of corn in the ration. Lots 5 to 7 served to study the value of cottonseed meal in rations of both heavy and light cattle and to compare the gains and profit made by each type.

Experiments with feeding steers, using cottonseed meal and varying proportions of corn and cottonseed meal, E. BARNETT and C. J. GOODELL (*Mississippi Sta. Bul. 214 (1923), pp. 29*).—Four steer feeding tests, using rations containing different proportions of corn and cottonseed meal were carried on during the winters of 1916–17, 1918–19, 1920–21, and the spring of 1920. The plan of all the tests was the same in that they lasted about 120 days and 4 lots of 2-year-old steers were fed on different rations, except that in the 1920–21 trial lot 4 was omitted. During the first half of each test the average daily rations per 1,000 lbs. of live weight consisted of lot 1 5 lbs. cottonseed meal, lot 2 4 lbs. cottonseed meal and 6.25 lbs. of broken ear corn, lot 3 3 lbs. of cottonseed meal and 12.5 lbs. of broken ear corn, and lot 4 2 lbs. of cottonseed meal and 18.75 lbs. of broken ear corn. As much corn silage as the steers would eat was fed to all lots.

During the second half of the test an additional pound of cottonseed meal was fed daily per 1,000 lbs. of live weight in each lot. Hogs following the steers received additional feeds of corn and tankage or cottonseed meal during the first two years. The following table gives a composite summary of the four trials:

Summary of four years' trials in fattening beef steers on rations containing different proportions of cottonseed meal and corn.

Lot.	Total number of steers.	Average initial weight.	Average daily gain.	Shrinkage in marketing.	Feed consumed per 100 lbs. gain.			Selling price per 100 pounds.	Dressing percentage based on home weight.	Pork credited per steer.
					Cottonseed meal.	Shelled corn.	Corn silage.			
		Lbs.	*Lbs.*	*Per ct.*	*Lbs.*	*Lbs.*	*Lbs.*			*Lbs.*
1	37	774.9	2.00	5.56	271.7	.....	2,451	$10.36	51.39	.....
2	36	773.1	2.19	6.07	211.4	201.5	1,884	10.55	51.74	20.2
3	36	780.3	2.38	5.53	161.0	372.5	1,551	10.83	52.86	42.8
4[1]	27	756.3	2.39	4.05	118.3	522.2	1,208	12.38	55.15	54.6

[1] No steers in this lot in the 1920–21 trial.

Steer feeding [at the Pennsylvania Station] (*Pennsylvania Sta. Bul. 176 (1922), pp. 9, 10*).—In continuation of the 2-year-old steer feeding tests noted (E. S. R., 47, p. 471), another year's results are reported. The six years' tests now indicate that rations consisting of corn silage full fed, 2.5 to 3 lbs. of cottonseed meal, and small amounts of corn stover produce cheaper gains and sufficient finish so that the steers sell for almost as much as steers receiving shelled corn.

Sunflower silage v. corn silage for the production of beef, H. HACKEDORN (*Washington Col. Sta. Bul. 175 (1922), pp. 10, 11*).—In a 75-day comparative test with sunflower silage and corn silage for beef production, two lots of 13 and 12 steers, respectively, were fed daily rations as follows: Lot 1, 2 lbs. of cottonseed meal, 13.2 lbs. of alfalfa hay, and 39.6 lbs. of corn silage, and lot 2, 2.1 lbs. of cottonseed meal, 12.4 lbs. of alfalfa hay, and 43 lbs. of sunflower silage. Average daily gains of 1.2 lbs. per head were made by the steers in each lot, and the condition of the animals was practically the same.

The practical value of hair color in cattle: Hair color and markings.—Experiments with Swiss breeds, F. X. WEISSENRIEDER (*Landw. Jahrb. Schweiz, 35 (1921), No. 6, pp. 787–813, fig. 1*).—This consists of a study of the amount, kinds, and location of pigments causing the different colors of hair in the Simmenthaler, Brown Swiss, and Freiburg breeds.

Pigment may be located in the marrow or at the border of the hair. The pigment in the border of the hair is of some shade of reddish brown and seems to be always present, whereas the marrow pigment may be entirely absent or of two kinds, both of which are shades of brown. The combination between the quality and the quantity of border and marrow pigments determine the color of the animal. On the basis of this study it is now possible to differentiate accurately three shades of gray and three of brown by a microscopic examination of the hair and thus get some idea of the breeding of the animals.

[Experimental work in zoology at the Idaho Station] (*Idaho Sta. Circ. 30 (1923), p. 11*).—Preliminary studies indicate that horns are transmitted as sex-linked characters in goats as well as in sheep.

The feeding of animals by the method of feeding equivalents.—The use of a graphical method of calculating rations of sheep to allow for growth, A.-M. LEROY (*Rev. Zootech. [Paris], 2 (1923), No. 2, pp. 103–116, figs. 7*).—A graphical method of calculating rations for growing sheep similar to the one previously noted for cattle (E. S. R., 48, p. 767) is given.

Winter feeding of breeding ewes, D. S. BELL (*Ohio Sta. Mo. Bul., 8 (1923), No. 1–2, pp. 17–21, fig. 1*).—Based largely on the results of experiments previously noted (E. S. R., 47, p. 773), the general principles of feeding pregnant ewes during the winter are described, and certain common rations are criticized.

Comparative methods of docking and castrating lambs (*Pennsylvania Sta. Bul. 176 (1922), pp. 10, 11*).—In continuation of the docking and castrating experiments (E. S. R., 47, p. 473), 35 lambs were docked with an emasculator and 35 with hot pincers. On the second day after docking, 57 per cent of those docked with the hot pincers were swollen and discharging, whereas only 17 per cent docked with the emasculator were so effected. Two weeks after the operation, of those docked with the hot pincers 11 per cent were healed and 50 per cent nearly so, as compared with 43 per cent healed and 50 per cent nearly healed of those docked with the emasculator. During the 14 days following the operation the lambs docked with the hot pincers gained 4.68 lbs. and those docked with the emasculator 4.98 lbs. The lambs castrated at docking time gained 4.84 lbs. and those not castrated 5.43 lbs. during the same length of time.

Inheritance in swine, E. N. WENTWORTH and J. L. LUSH (*Jour. Agr. Research [U. S.], 23 (1923), No. 7, pp. 557–582, pls. 2, fig. 1*).—An experiment, carried on from 1914 to 1918 at the Kansas Experiment Station, is reported in which certain characters in swine such as the shape of face, set of ears, color, mammary pattern, growth, and size of litter were studied in crosses between wild boars, Tamworths, Berkshires, and Duroc-Jerseys. The work was interrupted before its entire completion, but the following animals were obtained for study: 38 F_1s and 4 F_2s of wild boar × Tamworth, and 8 back crosses from an F_1 boar × Tamworth sow, 17 F_1s of wild boar × Berkshire sows, 10 F_1s of Berkshire boar × Tamworth sow, 29 F_1s of Berkshire boars × Duroc-Jersey sows, 151 F_2s, 11 F_3s, and 5 back crosses of an F_1 boar × F_2 sow, and 35 back crosses of an F_1 boar × a Duroc-Jersey sow.

The litter sizes ranged from 6 to 10, with an average of 7.86, for the purebred Tamworths and were 4 in the one litter of the F_1 wild × Tamworth; were 7 and 10 for the two litters of purebred Berkshires; ranged from 8 to 17, averaging 10.67, for the purebred Duroc-Jerseys; ranged from 3 to 12, averaging 8.88, for the F_1 Berkshire × Duroc-Jersey; and were 5 and 11 for the two F_2 litters of Bershire × Duroc-Jersey.

With regard to the set of the ears, it was concluded that the erect ears of the Berkshire are dominant by at least one and probably not more than three principal factors over the ears of the Duroc-Jersey type. Of the 42 F_2s only 1 was of the latter type, whereas in a back cross F_1 boar × Duroc-Jersey sow the ears of 4 of the pigs were of the Berkshire type, 4 were of the Duroc type, and 1 was not determined.

The face shape of the wild hog seemed to be dominant. The Tamworth face shape was dominant to the Berkshire, and the Berkshire was largely but not completely dominant to the Duroc face shape. The forehead shape of the Berkshire seemed to be more dominant than the dish or the length of the face.

In color the 38 F_1s wild × Tamworth were longitudinally striped with light red and dark brown stripes on the back and sides, with light red bellies. Four

F_2 pigs were similar, but the bellies were grayish white and light red, one of which was spotted. The 17 F_1 wild × Berkshire pigs were striped and also showed black spots which were larger than those of the F_2 wild × Tamworth, and they appeared mostly on the head. Of the 10 F_1 Berkshire ♂ × Tamworth ♀ 8 were red with black spots and 2 were self-red. The 29 F_1 Berkshire ♂ × Duroc ♀ were all black spotted over a yellowish red or sandy body color. The F_2s were classified as 47 black and red, 27 black and white, 14 self-red, 11 black and sandy, 10 black, red, and white, 10 black, red, and sandy, 7 sandy, 7 sandy and white, 6 black, sandy, and white, 3 red and sandy, 3 red and white, and 3 white.

The authors concluded that there is one dominant factor carried by the Berkshire which causes black. In the absence of this factor two dominant factors carried by the Duroc may act, the presence of either one of which may cause sandy, or both together cause red. A dilution factor is linked to the black factor which inhibits the action of one of the factors for sandy. The wild hog carried a single factor for immature striping and a hypostatic factor for black spotting, which was also carried by the Tamworth.

In regard to the growth rate, only the Berkshire-Duroc crossbreds are considered. The variability of the F_2s was much greater than in the F_1s, as would be expected. In one litter of 4 F_2 pigs at 11 months of age the weights were 221, 293, 90, and 170 lbs.

The study of the mammary pattern produced results which were in general in conformity with the previous study of Wentworth (E. S. R., 29, p. 470).

On the relative growth and development of various breeds and crosses of pigs, J. Hammond (*Jour. Agr. Sci. [England], 12 (1922), No. 4, pp. 387–423, figs. 5*).—This investigation, dealing with the British breeds of swine, was conducted in the same way as those previously noted on cattle (E. S. R., 46, p. 872) and sheep (E. S. R., 47, p. 866), i. e., from the records of the live and carcass classes of swine at the Smithfield Club's Fat Stock Shows from 1901 to 1913.

Determinations of the live weights, percentage of carcass, liver, pluck, and that part which is "unaccounted for," were made on pigs of 3, 5, 7, 9, and 11 months of age for 10 breeds. No records were kept of the sex, so it has been impossible to divide the pigs into sexes. The results have been divided into two periods, according to those obtained in the first part of the time and those obtained in the second, to study the progress that is being made in pig breeding. The results of crossbreds are also given, showing in each case which breeds the boars and sows belonged to.

Management of swine, J. Bagué (*Porto Rico Dept. Agr. and Labor Sta. Circ. 66 (1922), Spanish ed., pp. 31, pls. 7*).—This is a general description of the care and management of swine, containing descriptions of the different breeds and the methods of feeding and breeding.

Hogs and hog feeding [at the Irrigation Substation], R. P. Bean (*Washington Col. Sta. Bul. 175 (1922), p. 53*).—Thirty fall pigs (1921) were pastured until December 15 on alfalfa and divided into two lots for a feeding test which continued until April 11. Lot 1 received a ration of corn, fish meal, and mill-run, but in lot 2 alfalfa hay replaced the mill-run. Lot 1 gained 1.92 lbs. per pig daily and lot 2 1.76 lbs. Per 100 lbs. of gain the pigs in lot 1 consumed 315 lbs. of corn and fish meal and 100 lbs. of millrun, and the pigs in lot 2 consumed 350 lbs. of corn and fish meal and 87 lbs. of alfalfa. At the conclusion of the test the pigs in lot 1 were practically fat enough for market, whereas those in lot 2 were in excellent condition for fattening.

[**Swine feeding experiments at the Pennsylvania Station**] (*Pennsylvania Sta. Bul. 176 (1922), p. 11*).—The following experiments dealing with comparative rations or methods of feeding swine are reported in continuation of the results previously noted (E. S. R., 47, p. 474):

Protein supplements to corn for fattening swine.—Four lots of pigs on rape pasture, but receiving different protein supplements to shelled corn, required 403.8 lbs. of corn and tankage, 381.5 lbs. of corn and fish meal, 435.7 lbs. of corn and oil meal, and 395 lbs. of corn, tankage, and semisolid buttermilk, respectively, to produce 100 lbs. of gain. The average daily gains in the different lots were 1.96, 1.82, 1.33, and 1.85 lbs., respectively. The greatest net profit occurred using the fish meal as supplement.

Fattening rations for swine.—Dry lot.—Three lots of 85-lb. pigs were fed in dry lot during an 84-day test on the following rations: Lot 1 shelled corn, wheat middlings, and tankage; lot 2 shelled corn, buckwheat middlings, and tankage; and lot 3 shelled corn, wheat middlings, and fish meal. Average daily gains per head of 1.43, 1.24, and 1.27 lbs., respectively, were made by the different lots. For 100 lbs. of gain 479, 384.7, and 471 lbs., respectively, of feed were consumed. Buckwheat middlings was less palatable for swine than standard wheat middlings.

Hand feeding v. self-feeding.—The gains and feed consumed by one lot of 15 pigs, averaging 56 lbs. per head and fed in self-feeders, were compared with the gains and feed consumption of a similar hand-fed lot. The grain ration in both cases consisted of corn meal, buckwheat middlings, and tankage. During the 99-day test the self-fed lot gained 1.3 lbs. per head per day as compared with 0.88 lb. per day for the hand-fed lot. The profit above feed cost per pig was $7.41 in the self-fed lot and $3.18 in the hand-fed lot.

Hogging down crops.—Cost of producing crops and pork, A. F. Kidder and W. H. Dalrymple (*Louisiana Stas. Bul. 187 (1923), pp. 3–19*).—Two years' experiments in raising pigs on oat pasture are reported. During 1921 52 pigs were raised from 6 sows, and during 1922 65 were raised from 10 sows. The following table shows the amount of feed, exclusive of the oat pasture, that was required to raise them to a suitable age for use in an experiment in hogging down different crops:

Cost of raising pigs.

Year.	Number of pigs.	Total weight.			Feed consumed.			
					Suckling period.		Weaning to hogging-down period.	
		At farrowing.	At weaning.	At beginning of hogging-down period.	Grain.	Skim milk and buttermilk.	Grain.	Skim milk and buttermilk.
		Lbs.	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*
1921	52	149.6	1,480	6,500	2,613	2,320	13,110	16,000
1922	65	170.7	1,590	5,755	2,840	.....	18,515	.....

In 1919, 1920, 1921, and 1922 experiments were carried on in hogging down different crops, the results of which are given in the following table:

Summary of the hogging-down experiments.

Year.	Crops.	Number of acres.	Dates of grazing.		Number of days.	Number of hogs.	Initial weight of hogs.	Average daily gain.	Feed consumed per pound of gain.
			Beginning.	End.					
							Lbs.	*Lbs.*	*Lbs.*
1919	Corn and cowpeas	2	Sept. 16	Oct. 1	16	25	2,600	1.65	4.9
	Sweet potatoes	2.75							
	Corn	2.125	Oct. 2	Nov. 6	36	35	4,865	1.13	7.1
	Soy beans	2.125							
	Sweet potatoes	2	Nov. 7	Dec. 7	31	35	6,290	1.49	11.1
	Soy beans	2							
1920	Corn and cowpeas	2	Aug. 28	Oct. 5	39	26	1,810	.52	5.3
	Corn	2	Oct. 6	Nov. 5	30	26	2,340	1.06	3.4
	Soy beans	1							
	Sweet potatoes	2	Nov. 6	Nov. 21	16	26	3,170	1.02	21.4
1921	Corn and cowpeas	1.1	Aug. 21	Aug. 30	10	52	6,500	.23	14.7
	Corn and soy beans	4	Aug. 31	Sept. 15	16	51	6,535	2.3	5.9
	Sweet potatoes	.5							
	Sweet potatoes	1	Sept. 16	Sept. 26	11	51	8,435	.68	11.7
	Soy beans	1.1							
	Sweet potatoes	2	Sept. 27	Oct. 9	13	40	6,500	1.8	8.2
	Soy beans	2							
1922	Corn and cowpeas	1.1	Aug. 22	Sept. 15	25	10	960	1.5	5.0
	Corn and soy beans	2	Aug. 30	Sept. 18	20	33	2,315	.95	5.0
	Corn and soy beans	2	Aug. 30	Sept. 12	14	20	2,440	1.6	6.4
	Soy beans	.5							
	Sweet potatoes	1.1	Sept. 23	Oct. 2	8	63	7,615	1.4	7.3
	Soy beans	1							
	Sweet potatoes	2	Oct. 10	Oct. 23	14	40	4,680	1.8	12.4
	Soy beans	2							

It was concluded that corn and soy beans produced the cheapest gains and made a good combination with sweet potatoes, but hogging down sweet potatoes alone resulted in a loss. Cowpeas were unsatisfactory and should be replaced by soy beans in southern Louisiana. The costs of raising the different crops are reported according to the horse and man labor required, and the cost of producing 100 lbs. of pork with the corn and soy beans was estimated at 13.6 man hours and 21.6 horse hours.

Analyses of different parts of sweet potato vines are also reported.

The curing of bacon and ham on the farm, W. A. K. Morkel (*Union So. Africa Dept. Agr. Jour., 6 (1923), No. 1, pp. 36–51, figs. 8*).—Besides discussing the methods of curing hams and bacon, the author describes the feeding, breeding, and slaughtering of pigs.

Discussions and demonstrations on breeding problems (*Kentucky Sta. Circ. 30 (1922), pp. 39–93, fig. 1*).—This consists of the papers and descriptions of the demonstrations, with an introduction by T. Cooper, which were presented before a conference of live-stock breeders held in March, 1922, at the Kentucky Station.

Abortion, sterility, and breeding hygiene, C. Way (pp. 41–58).—This is a practical discussion of the problem of abortion in mares, with reference to the best method of treatment, largely by means of hygienic measures.

Report of progress of work on sterility, W. W. Dimock (pp. 59–68).—In a total of 97 mares that have been examined in the work on sterility at the Kentucky Station 13 were suffering with vaginitis and 27 with purulent inflammation of the uterus from which cultures of a streptococcus were isolated. *Micrococcus pyogenes varians albus* and *Bacillus coli* were isolated from a like

number of cases, and a short rod of the colon typhoid group was recovered from 15 cases. Suggested methods of treating barren mares are given.

Infectious abortion of mares, E. S. Good (pp. 69–74).—The losses due to infectious abortion in mares are discussed, and the work in isolating the germ causing it and the preparation of serums and vaccines are described. It is pointed out that this organism apparently plays no part in abortions occurring early in pregnancy.

Genetics in relation to horse breeding, W. S. Anderson (pp. 75–78).—A few of the general principles of heredity are discussed in popular form.

Sterile males, W. S. Anderson (pp. 79–82).—The material presented is similar to a portion of the material in Bulletin 244 (E. S. R., 49, p. —).

The H-ion concentration of horse semen, Anderson, A. M. Peter, and D. J. Healy (pp. 85–93).—Practically the same material has been noted in a previous article (E. S. R., 47, p. 771).

Stallion enrollment.—XI, Report of stallion enrollment work for the year 1922, with lists of stallions and jacks enrolled (*Indiana Sta. Circ. 108 (1922), pp. 56, fig. 1*).—As in previous reports of the Indiana stallion enrollment board (E. S. R., 46, p. 768), this consists largely of a directory of enrollments and renewals for the calendar year 1922.

Farm poultry (*Ontario Dept. Agr. Bul. 292 (1922), pp. 88, figs. 84*).—This is a general manual of poultry production, dealing with the breeds, methods of feeding, care, housing, breeding, killing, and dressing poultry, and handling and grading eggs.

Protein—its value for poultry, J. E. Dougherty (*Poultry Sci., 2 (1923), No. 3, pp. 85–89; also in Natl. Poultry Jour., 3 (1923), No. 151, pp. 677, 678*).—This is essentially a brief review of the lack of definite knowledge about the feeding value of different protein feeds of varying composition, such as meat scrap and fresh and dried buttermilk. Emphasis is given by citations from various experiments.

Poultry husbandry [at the Idaho Station] (*Idaho Sta. Circ. 30 (1923), p. 10*).—The first year's study of the sources of protein for laying hens indicates that skim milk may replace meat scrap, and that when skim milk is fed with peas or pea meal the feeding value is increased. With milk there was an average yearly production of 47.4 per cent for Leghorn pullets.

Producing winter eggs, D. C. Kennard (*Ohio Sta. Mo. Bul., 8 (1923), No. 1–2, pp. 28–32*).—This is a general discussion of the essentials in management, feeding, and breeding that are necessary for high winter egg production, and is based on results obtained at the station.

Poultry meat production, P. A. Hayden (*New Jersey Stas., Hints to Poultrymen, 11 (1923), No. 8, pp. 4*).—The desirable types of poultry for meat purposes, methods of fattening, killing, and selling, and the classes of market poultry are described. A summary of the comparative rate of growth of Jersey Black Giant capons and pullets for the first 30 weeks is given. The mortality of the capons was 23.2 per cent and of the pullets 15 per cent. The total gains per bird were, respectively, 7.1158 and 6.1515 lbs.

Brooding the chicks, W. P. Thorp, jr. (*New Jersey Stas., Hints to Poultrymen, 11 (1923), No. 7, pp. 4, fig. 1*).—This is a popular description of the methods of artificial brooding.

Visual perception of the chick, H. C. Bingham (*Behavior Monog., 4 (1922), No. 4, pp. V+106, figs. 7*).—This is a detailed report of a rather extensive psychological study of sight in four lots of Plymouth Rock chicks carried on in the psychological laboratory of Harvard University.

Biometric considerations on the inheritance of fecundity in the White Leghorn fowl, J. A. Harris and H. R. Lewis (*Poultry Sci., 2 (1923), No. 3,*

pp. 65–74, figs. 2).—Data collected from the egg records of 402 daughters of 287 Single Comb White Leghorn hens, which also made trap-nest records as pullets and yearlings in the Vineland International Egg-Laying and Breeding Contest, were studied statistically. The following constants were obtained for the pullet year and the second year of the dams and the pullet year of the daughters' production, respectively: Mean 176.6±1.26, 144.2±1.16, and 190.3±1.47; standard deviation 37.4±0.89, 34.5±0.82, and 43.6±1.04; and coefficient of variability 21.2±0.525, 23.9±0.6, and 22.9±0.57. The coefficient of correlation obtained between the daughters' production and the dams' pullet year production was 0.1279±0.0331 and the daughters' production and the dams' second year production 0.1961±0.0323, being 3.86 and 6.07, respectively, times the probable error. A discussion of the occurrence of the variation is given by graphical and statistical methods.

An approximate method of calculating the surface area of eggs, L. C. Dunn and M. Schneider (*Poultry Sci., 2 (1923), No. 3, pp. 90–92*).—A formula for calculating the surface area of eggs has been derived from the theorem that the surface area of solids of similar shapes vary as the two-thirds power of their volume. By determining the area and weight of 25 eggs laid on the same day and dividing the area in square centimeters by the two-thirds power of the weight, the quotients varied from 4.51 to 4.72, averaging 4.6308±0.0066 with a standard deviation of 0.0488. The complete formula for determining the area of eggs in square centimeters when the weight in grams is known was

$$\text{Area} = 4.63 \times \text{weight}^{2/3}$$

DAIRY FARMING—DAIRYING.

[Dairy cattle experiments at the Pennsylvania Station] (*Pennsylvania Sta. Bul. 176 (1922), pp. 13, 14, 15*).—The results of the following experiments are reported, some of which are continuations of those previously noted (E. S. R., 47, p. 478):

A study of the stage of maturity of ensilage corn.—In a feeding trial of 3 month's duration green corn silage (cut when ears had scarcely any grain on them) was found to be less efficient for milk production than mature silage (cut 32 days after the green silage and ears were well dented). In another trial medium mature silage (ears in the roasting stage) was found superior to the green silage.

Canada field peas and oat silage.—Cows fed Canada field pea and oat silage produced larger yields of milk than other cows receiving no silge. From the results of this trial and the one during the previous year it is concluded that though oat and pea silage is not equal to corn silage in feeding value, it is still much better than no silage at all.

Protein requirements for growth of cattle.—Two Holstein calves were fed for 135 days on a high-protein ration for comparing their growth rate with two other calves fed on a low-protein ration. The high-protein ration produced a gain of 36.5 per cent of the initial weight, while the low-protein ration produced a gain of 38.3 per cent. All body measurements except height at withers indicated greater growth production by the low-protein ration. In a second trial of 245 days' duration two Holstein and two Jersey calves were used. Average daily gains of 0.901 lb. were made on the high-protein ration, while gains of only 0.301 lb. were made on the low-protein ration.

A study of the effects of leaving milk in the udder at the last milking preceding the regular semiofficial monthly test of pure-bred cattle.—"The results to date indicate that leaving one-fourth of the milk in the udder at the last

milking preceding the regular semiofficial monthly test will slightly increase the yield of milk, the fat test, and the yield of butter fat during the regular two-day test."

A study of calf rations, E. V. ELLINGTON (*Washington Col. Sta. Bul. 175 (1922), pp. 18, 19*).—The three years' results of tests in feeding calves condensed buttermilk, powdered skim milk, whole milk, skim milk, and commercial and home-mixed calf meals are more fully reported than previously (E. S. R., 47, p. 581).

California State dairy cow competition, 1920–1922, F. W. WOLL (*California Sta. Bul. 351 (1922), pp. 185–244, figs. 15*).—The California State dairy cow competition, held from 1920 to 1922, is reported very much as the 1916–1918 contest (E. S. R., 40, p. 375).

The effect of exercise and feed upon the vitality and breeding ability of bulls, E. V. ELLINGTON (*Washington Col. Sta. Bul. 175 (1922), p. 20*).—Another year's results of this experiment corroborated the conclusions of the previous experiments (E. S. R., 45, p. 275).

The fat content of mothers' milk, H. YOUNG (*Internatl. Assoc. Dairy and Milk Insp. Ann. Rpt., 11 (1922), pp. 129–132*).—Attention is called to the wide variations in the fat content of human milk. In 460 specimens examined by the author, the fat content varied from less than 1 to over 10 per cent, with an average of 3.2 per cent. In the specimens containing from 1 to 5 per cent fat, almost equal numbers were found within each 0.5 per cent variation. This was true not only of the entire number of samples submitted, but also of a smaller number, 59, submitted by a single physician and thus obtained by using the same general directions as to collection. The appearance of a sample was found to be a very poor index of its actual fat content.

Determinations of the specific gravity of fresh milk, A. BAKKE and P. HÖNEGGER (*Lait, 3 (1923), No. 1, pp. 3–10*).—Variations of the specific gravity of milk after holding certain lengths of time, especially after pasteurizing and cooling, have been observed, and the causes of such variations are discussed.

The cryoscopic examination of milk, J. HORTVET (*Internatl. Assoc. Dairy and Milk Insp. Ann. Rpt. 11 (1922), pp. 72–85*).—The data presented in this paper have for the most part been reported in previous papers by the author (E. S. R., 47, p. 314) and by Bailey (E. S. R., 47, p. 505).

Report of committee on methods of bacterial analysis of milk and milk products, G. E. BOLLING (*Internatl. Assoc. Dairy and Milk Insp. Ann. Rpt., 11 (1922), pp. 203–206*).—Comparative bacterial counts of samples of milk were made with the use of different media at seven different laboratories. Considering the count on standard meat extract agar as 100, the averages of the counts on the other media were meat infusion agar 105.9, dehydrated bacto agar 134.4, bacto agar with milk 174.5, desiccated milk agar 183.5, Ayers spray process milk agar 161.4, Ayers Just process milk agar 199.5, meat extract agar plus 1 per cent lactose 149.7, and meat infusion agar plus 1 per cent lactose 193.3. The committee were strongly in favor of having a central source of standard media, which it was thought would be of great assistance in getting uniform results in different laboratories.

Municipal and factory milk inspection, J. GAUB (*Internatl. Assoc. Dairy and Milk Insp. Ann. Rpt., 11 (1922), pp. 61–66*).—This is a review of the different tests which may be used for determining acidity, alcohol, bacteria, coagulability, dirt, diseases of the udder, pasteurization, etc., of milk.

The creamery and tester's license law (*Kentucky Sta. Regulatory Ser. No. 1 (1918), pp. 14*).—The creamery and tester's license law of Kentucky is explained and given in full.

The Babcock test for butter fat (*Kentucky Sta. Regulatory Ser. No. 2 (1918), pp. 23, figs. 20*).—The testing of milk, cream, buttermilk, and skim milk for butter fat by the Babcock test is described.

Report of the creamery license section, July 1, 1918, to June 30, 1922, P. E. BACON (*Kentucky Sta. Regulatory Ser. No. 3 (1922), pp. 15, fig. 1*).—This is a summary of the operation of the Kentucky creamery and tester's license law from 1918 to 1922. The number of creameries and testers licensed during each year are given, as well as a brief review of the law.

Report of committee on dairy methods, T. J. MCINERNEY (*Internatl. Assoc. Dairy and Milk Insp. Ann. Rpt., 11 (1922), pp. 164–172; also in Creamery and Milk Plant Mo., 12 (1923), No. 5, pp. 45–47*).—In the production of clean milk the care of the cattle, cleanliness of the buildings and utensils, straining and cooling of the milk, and general attitude of the dairyman are emphasized.

Structure and equipment of the modern milk plant, C. L. ROADHOUSE (*Internatl. Assoc. Dairy and Milk Insp. Ann. Rpt., 11 (1922), pp. 181–187*).—Suggestions are given for the construction of a modern milk plant.

Transportation of milk in metal tanks, R. S. SMITH (*Internatl. Assoc. Dairy and Milk Insp. Ann. Rpt., 11 (1922), pp. 133–148*).—A discussion is given of the use of metal tanks for conveying milk by rail and on trucks. The changes in temperature which have occurred in the milk in different instances are reported, and emphasis is placed on the necessity of following certain directions when tanks are used.

Report of the committee on pasteurization of milk and cream, W. H. PRICE (*Internatl. Assoc. Dairy and Milk Insp. Ann. Rpt., 11 (1922), pp. 108–128; also in Creamery and Milk Plant Mo., 12 (1923), No. 4, pp. 40–47*).—This is the report of the chairman of the committee for studying the pasteurization of milk and cream, in which it is recommended that only the holding type of pasteurization be considered as standard and permissible. Only apparatus which is easily cleaned and efficient should be used. After heating, the milk should be quickly cooled to 45° F. or lower. The necessity of automatic temperature controlling devices is brought out.

The relation of temperature to cream layer in pasteurized milk, C. H. KILBOURNE (*Internatl. Assoc. Dairy and Milk Insp. Ann. Rpt., 11 (1922), pp. 154–158; also in Creamery and Milk Plant Mo., 12 (1923), No. 4, pp. 52b, 52c*).—In continuing the study of the effects of pasteurization on the cream line (E. S. R., 33, p. 79), tests at five different plants have shown that variable results occurred when milk was pasteurized at from 137 to 145° F. Due to the danger to the quality of the milk with the higher temperatures, it is suggested that the milk be held at 142° for at least 30 minutes.

Constructive policies and methods for milk improvement, V. J. ASHBAUGH and G. C. SUPPLEE (*Internatl. Assoc. Dairy and Milk Insp. Ann. Rpt. 11 (1922), pp. 97–104*).—This deals with the tests which it seems desirable to make of milk delivered by each dairyman to a milk plant, and methods are suggested whereby the producer is informed of his mistakes and corrective methods are explained.

Dairy control, F. D. WALMSLEY (*Internatl. Assoc. Dairy and Milk Insp. Ann. Rpt., 11 (1922), pp. 149–153*).—The author believes that to insure a good product the milk inspector from the milk dealer's plant should visit the producer regularly and point out in a diplomatic manner the way in which the quality of the raw milk might be improved.

Eleventh annual report of the International Association of Dairy and Milk Inspectors, compiled by I. C. WELD (*Internatl. Assoc. Dairy and Milk Insp. Ann. Rpt., 11 (1922), pp. 261*).—This is the report of the meeting of the

International Association of Dairy and Milk Inspectors held at St. Paul, Minn., October 9–11, 1922. Besides the papers which are abstracted elsewhere, the following were given: Report of Committee on Bovine Diseases, Their Relation to the Milk Supply and to the Public Health, by G. H. Grapp; Report of Committee on Transportation and Marketing of Milk and Milk Products, by C. W. Eddy; The Effect of Steam on the Germ Life in Milk Cans, by H. A. Harding (E. S. R., 47, p. 582); The Relation of the Milk Inspector to the Milk Plant Manager, by C. E. Clement; World's Dairy Congress Association, by H. E. Van Norman; Administrative Standards for the Control of City Milk Supplies, by I. V. Hiscock (E. S. R., 48, p. 79); The Efficiency of Milk Plant Machinery, by C. O. Seaman; The Transportation and Handling of Milk, by C. Brieault; Report of Committee on Serving Milk in Schools, by C. L. Roadhouse; Ice Cream and the Health Officer, by B. Vener; Remarks Regarding Bovine Disease, by F. L. Evans; The Organization and Administration of Milk Control, by L. C. Bulmer; Market Milk Conditions in Iowa, by O. P. Thompson; Report of Committee on Marketing Milk and Milk Products, by W. P. B. Lockwood; Report of Special Membership Committee for 1922, by J. O. Jordan; Production and Distribution of London's Milk Supply, by A. G. Raymond; Sanitation and the Milk Supply of London, by E. A. Evans; Report of Committee on City Milk Contests, by R. S. Smith; Bacterial Counts of Milk as Obtained by Various Media, by G. C. Supplee and G. E. Flanigan; and Report of Committee on Food Value of Milk and Milk Products, by O. M. Camburn, as well as addresses by C. Heen, G. E. Bolling, H. E. Bowman, and S. H. Greene.

A successful method of dealing with surplus milk, J. G. Aston and C. T. Sproston (*Jour. Min. Agr. [Gt. Brit.], 29 (1923), No. 12, pp. 1075–1078*).—This is an account of the establishment of a cheese factory by the members of the Frodsham Branch of the National Farmers' Union for the purpose of taking care of surplus milk.

Problems in the manufacture of ice cream (*Pennsylvania Sta. Bul. 176 (1922), p. 15*).—In addition to the results previously noted (E. S. R., 47, p. 482), it was concluded that heavy concentrated evaporated milks are more difficult to handle and have no advantage over lighter concentrations for ice cream making. "Improvers" increase the viscosity but result in a "livery" mix and ice cream.

Results of further investigations of remade milk and milk powder, O. L. Evenson (*Internatl. Assoc. Dairy and Milk Insp. Ann. Rpt., 11 (1922), pp. 241–246*).—In a further study of methods of distinguishing remade milk from natural pasteurized milk (E. S. R., 47, p. 111), it was found that the cream separator does not remove the fat so completely from emulsified milk as from milk which has not been thus treated. As determined by the Roese-Gottlieb method, the percentage of fat in the skim milk from 23 samples of natural pasteurized milk varied from 0.14 to 0.25 per cent, with an average of 0.19 per cent, while in 21 samples of emulsified remade milk or emulsified natural milk the figures varied from 0.4 to 0.86 per cent, with an average of 0.57 per cent. The skim milk from 14 samples of mixtures containing from 15 to 20 per cent of emulsified remade milk varied in fat content from 0.24 to 0.28 per cent. It is concluded that the presence of a large amount of fat in the skim milk obtained with a cream separator from an unknown sample of milk as compared with the fat in the skim milk obtained with the same separator under the same conditions from a known sample of pasteurized milk is an indication of the use of an emulsor, and may be of assistance to the milk inspector in detecting remade milk.

A comparison was also made of the relative viscosity of natural and remade milk calculated from the formula.

$$V=\frac{\text{Time of flow of milk} \times \text{specific gravity of milk.}}{\text{Time of flow of water} \times \text{specific gravity of water.}}$$

and of the relation of viscosity to total solids represented by the expression $\frac{100\ (v-1)}{\text{T S}}$ in which v=the relative viscosity and T S=percentage of total solids. On determining the relative viscosity at 25° C., the values of this expression for different samples of milk varied as follows: For natural pasteurized milk from 5.68 to 7.18, for remade milk 6.37 to 12.60, and for mixtures containing from 15 to 20 per cent of remade milk from 5.96 to 8.37. These values are thought to show too little difference to enable the detection of remade milk to be possible by viscosity determinations.

The color test described in the previous paper has been found to be applicable, with slight modifications, to the albumin of milk powder and thus to remade milk in which there has been no or only slight coagulation of the albumin.

VETERINARY MEDICINE.

Comparative anatomy of the domesticated animals, F.-X. Lesbre (*Précis d'Anatomie Comparée des Animaux Domestiques. Paris: J.-B. Baillière & Son, 1922, vol. 1, pp. VIII+683, figs. 293; 1923, vol. 2, pp. 785, figs. 319*).—This is an abridgement of the work on comparative anatomy by A. Chaveau, S. Arloing, and Lesbre, of which five editions have been issued.

A textbook of pathology, W. G. MacCallum (*Philadelphia and London: W. B. Saunders Co., 1921, 2. ed., rev., pp. XV+1155, pl. 1, figs. 612*).—A reprint of the volume previously noted (E. S. R., 45, p. 278).

Veterinary hygiene: Care of health and general science of contagious diseases of domesticated animals, M. Klimmer, trans. by A. A. Leibold (*Chicago: Alexander Eger, 1923, 3. ed., rev., pp. 431, figs. 270*).—This is a translation of the third German edition of the author's Veterinärhygiene (E. S. R., 46, p. 178). The several sections of the work deal, respectively, with the atmosphere (pp. 22–55), the soil (pp. 56–70), water (pp. 71–110), noxious agents in feeds (pp. 111–173), the care and management of animals (pp. 174–220), the pasture and exercising lot (pp. 221–258), the stable (pp. 259–341), and contagious diseases (pp. 342–421).

Proceedings of the thirty-ninth and fortieth annual meetings of the Michigan State Veterinary Medical Association held at East Lansing, February 8 and 9, 1921, and February 7 and 8, 1922 (*Mich. State Vet. Med. Assoc. Proc. 39–40 (1921–1922), pp. 137*).—The proceedings for 1921 and 1922 are presented.

[Report of the] division of veterinary science, J. W. Kalkus (*Washington Col. Sta. Bul. 175 (1922), pp. 45, 46*).—The author reports briefly upon investigations of the orchard horse disease, an account of which has been previously noted (E. S. R., 43, p. 473), and upon redwater in cattle.

Reports of proceedings under the diseases of animal acts, with returns of the exports and imports of animals for the years 1918, 1919, and 1920, D. S. Prentice (*Ireland Dept. Agr. and Tech. Instr., Rpts. Diseases Anim., 1918, pp. 32; 1919, pp. 32; 1920, pp. 34*).—These are the usual annual reports (E. S. R., 41, p. 280), containing statistical data on the occurrence of hog cholera, anthrax, glanders, parasitic mange, sheep scab, tuberculosis, etc.

Report of the veterinary department [Gold Coast] for the year 1921, W. J. Moody (*Gold Coast Vet. Dept. Rpt. 1921, pp. 20*).—This includes a report

of the occurrence and control work with contagious and infectious diseases of live stock.

An experimental study on malt-sprout poisoning, U. TANAKA (*Jour. Japan. Soc. Vet. Sci., 2 (1923), No. 1, pp. 93–99*).—The author concludes that the disturbances caused by ingestion of malt sprouts are due to the action of hordenin, and alkaloid naturally contained in it, but that the toxicity of this alkaloid is very weak.

Tumors and heredity, A. RIVERA (*Porto Rico Dept. Agr. and Labor Sta. Circ. 69 (1922), Spanish ed., pp. 5–8*).—A brief popular discussion.

The comparative pathology of valvular endocarditis, J. LAZITCH (*Ueber Vergleichende Pathologie der Endocarditis Valvularis. Inaug. Diss., Univ. Bern., 1921, pp. 32*).—A report of studies of this affection, which the author finds to occur much less frequently in domestic animals than in man.

Immunologic significance of vitamins, I–III, C. H. WERKMAN (*Jour. Infect. Diseases, 32 (1923), No. 4, pp. 247–269*).—Three papers are presented.

I. *Influence of the lack of vitamins on the production of specific agglutinins, precipitins, hemolysins, and bacteriolysins in the rat, rabbit, and pigeon* (pp. 247–254).—In this investigation young rabbits and rats were kept on diets deficient in vitamins A and B, respectively, and pigeons on polished rice and on the vitamin B-deficient diet used for the rats. After the characteristic symptoms of lack of the specific vitamins had appeared, the blood sera was tested for the production of various antibodies. *Bacterium typhosum* was used as the antigen for the production of agglutinins in the rat, rabbit, and pigeon, human serum as antigen in the precipitin tests in rats, and *B. typhosum* in the production of bacterial lysins in rats and rabbits. Rabbit erythrocytes were used for hemolysin production in rats and rat erythrocytes for rabbits. The sera of control animals on normal diets were tested similarly.

In no case was there any evidence of differences between the control and experimental animals in their inability to form antibodies. "It is, therefore, reasonable to conclude that cataphylaxis in animals suffering from the lack of vitamins is not the result of the destruction or paralysis of the antibody-forming mechanism that produces agglutinins, precipitins, hemolysins, or bacteriolysins."

II. *Influence of lack of vitamins on resistance of rat, rabbit, and pigeon to bacterial infection* (pp. 255–262).—This paper reports an investigation of the effect of a deficiency of vitamins A and B on the resistance of rats, pigeons, and rabbits to *Bacillus anthracis.*

Six rats suffering from lack of vitamin A and 6 healthy controls were injected intraperitoneally with a dose of *B. anthracis* sufficient to kill rabbits regularly in 48 hours. All of the test animals died from anthrax infection within 120 hours, while none of the controls were affected. No difference was noted in the coagulation time of the blood in the vitamin-deficient animals, but a drop in the number of blood platelets was noted. In another series a similar increase in susceptibility to a diplococcus isolated from a dying rat was also noted.

In a similar test conducted on rabbits with a culture of *B. anthracis*, of a virulence to kill guinea pigs in 0.1 cc. injection but not regularly fatal to rabbits, 4 of the 6 test animals and 1 of the 4 controls died.

In tests conducted on pigeons fed either polished rice or a diet lacking only in vitamin B, all of the test birds died following injection with *B. anthracis* and all of the controls lived. Similar results were obtained with a pneumococcus. A lowering of the rectal temperature of the test pigeons was noted.

Of 11 rats lacking vitamin B and 5 controls, all of which received 1.25 cc. of a suspension of *B. anthracis*, 7 of the test animals and 1 of the controls died.

III. *Influence of the lack of vitamins on the leucocytes and on phagocytosis* (pp. 263–269).—In this paper the results are reported of a comparison of the phagocytic activity in normal and immune rats and rabbits lacking vitamins A or B. Experiments were carried out both in vitro and in vivo, using the same strength of *Bacterium typhosum* and in one experiment *Staphylococcus albus.*

The experiments in vitro showed no marked variation in the phagocytic indexes of the test and control animals either nonimmunized or immunized. In vivo, however, the indexes were consistently slightly greater in the controls than in the test animals. These results are considered of possible significance in suggesting some depressive action on the phagocytic mechanism during vitamin deficiency.

The source of agglutinins in the milk of cows, T. SMITH, M. L. ORCUTT, and R. B. LITTLE (*Jour. Expt. Med., 37 (1923), No. 2, pp. 153–174*).—The studies reported in this paper were undertaken to determine whether the high agglutinin content for *Bacillus abortus* of milk of infected cattle is due to a local production of agglutinins in the udder or to increased permeability of the udder tissue to blood agglutinins in the presence of *B. abortus.*

A preliminary test to determine whether the fore and hind quarters of the udder are in communication with one another through their ducts was conducted on a cow about to be slaughtered. This animal was injected in the left fore quarter of the udder with a suspension of *B. abortus,* and 23 hours later was killed, the udder was removed, and portions of the four quarters were fixed in Zenker fluid. The microscopic examination of these sections showed in the injected quarter an extensive filling up of the secreting alveoli with polynuclear leucocytes, which also permeated the epithelium and the interstitial tissues. The other quarters showed only slight focal infiltration. "It is highly probable, therefore, that if any communication exists between the ducts of the fore and hind quarters it is very restricted."

In the agglutination tests in the investigation proper the milk was clarified by rennet after the removal of the cream. The clear whey was used in a manner similar to blood serum, the dilution being made with normal salt solution.

In the first experiment a suspension of living bacilli was injected into the ducts of the right fore quarter of the udder. Observations were made on the general appearance of the animal, the amount, quality, and bacteriological flora of the milk, and, at frequent intervals after the third day, on the agglutinin content of the milk obtained from the injected and uninjected quarters. After about 10 weeks the left fore quarter was similarly injected, and similar observations were subsequently made.

The first injection was followed by a prompt reaction, characterized by elevation of temperature for about 2 days, swelling and tenderness of the injected quarter, and changes in the physical appearance and quantity of the milk secreted. The agglutinin content of the milk from the injected quarter rose slightly after 3 days and to a marked extent after 10 days, at which time there was a slight increase in the agglutinin content of the milk from the other quarter, the titers being 1:640 in the injected and 1:320 in the other quarter. The agglutinin titer of the blood was not examined from the third day, when it was between 1:40 and 1:80, to the thirteenth day, when it was 1:1,280. The titer of the blood remained high after that of the milk had decreased.

The second injection was followed by a more marked response than the first. The milk agglutinins rose promptly in the injected quarter and to an equal extent in the quarter previously injected, and somewhat in the other quarters after 2 days. The blood titer rose and remained high.

Guinea pigs inoculated intraperitoneally with milk from the injected quarter shortly before the second injection remained free from *B. abortus* lesions. "The tentative inference to be drawn from this experiment was a local production of agglutinins in the inoculated quarters. The appearance in the other quarters and in the blood may be ascribed to the dissemination and multiplication of the bacilli both locally in the udder and generally in the system."

Two further experiments were conducted, using dead instead of living organisms. In the first of these experiments a cow was given 3 subcutaneous and 1 intravenous injection of a heated suspension of *B. abortus*. There was a very marked increase in the agglutinin titer of the blood, which rose from 1:40 to 1:2,560 in 71 days. The titer of the milk during the same period rose only from 1:10 to 1:40. On the seventy-eighth day of the experiment an injection of the dead organisms was made directly into the cistern of the right fore quarter of the udder. Following this injection the agglutinins in the milk from the injected quarter rose slowly to 1:640 and to a less degree in the other quarters, the maximum reached being 1:320. In 4 other cases the heat-killed organisms were injected directly into the udder in a manner similar to the first experiment without preliminary subcutaneous or intravenous injection. The general reaction following this was, first, a rise in the agglutinins in the injected quarter, accompanied by an increase in the blood agglutinins usually higher than that of the treated quarter, and followed by a slight rise in one or more of the remaining quarters.

The second injection into another quarter was followed by a more rapid rise in the agglutinin content of the milk in the injected quarter, accompanied by a similar rise in the quarter first treated and a slight additional rise in the two remaining quarters. The injection of the dead organisms into the udder was followed by a slight febrile disturbance lasting about 24 hours, accompanied by tenderness and swelling in the injected quarter.

The authors conclude that "the evidence, as far as it goes, appears to support the hypothesis that after the injection of living or dead bacteria into the udder ducts the increased agglutinin is produced mainly in the udder tissue, and that it is not due to an increased permeability of the endothelium or the epithelium of the gland."

Microbic virulence and host susceptibility in mouse typhoid infection, L. T. Webster (*Jour. Expt. Med., 37 (1923), No. 2, pp. 231–267, figs. 7*).—This and the following paper continue the attempt to analyze the factors responsible for the sporadic and epidemic mouse typhoid infection which has been under investigation at the Rockefeller Institute for Medical Research (E. S. R., 49, p. 79). In the present study an attempt was made to study the equilibrium between microbic virulence and host susceptibility in artificially induced mouse typhoid. The general procedure was to inject a series of mice per os by a stomach tube with fixed doses of *Bacillus pestis caviae*, and at short intervals following this injection to observe the condition of the animals, examine stools and blood for the presence of the ingested organism, note the general characteristics of the fecal flora, and test the blood for homologous agglutinins.

The strain of *B. pestis caviae* employed showed no permanent change in virulence during the 10 months in which the experiments were being conducted, but striking variations in the susceptibility of the mice to the organism were noted. These variations are summarized as follows:

"In any series infected per os with a fixed dose, 20 to 30 per cent show no sign of infection, no positive blood cultures, and no agglutinins; 5 or 10 per cent present symptoms of disease, positive blood cultures, and then recover

with or without homologous agglutinins; and 70 or 80 per cent develop positive blood cultures and succumb in a more or less constant ratio relative to time."

Contribution to the manner of spread of mouse typhoid infection, L. T. WEBSTER (*Jour. Expt. Med., 37 (1923), No. 2, pp. 269–274, figs. 4*).—In this paper experiments are described which deal with the effect of spacial and quantitative distribution of the bacilli on the spread of mouse typhoid in a given mouse population. In the first series of experiments inoculated and uninoculated mice were brought together in different proportions, and in the second varying numbers of mice all receiving the same inoculating dose were brought together in single cages.

In the first series the death rate was highest in those cages in which the proportion of inoculated to uninoculated animals was the highest, and in the second in the cages in which the crowding was greatest, thus showing that the death rate varied with the available dosage of the organism.

Using the experimental results reported in this and the preceding paper, the author has constructed a curve with coordinates similar to those employed by Amoss in recording the mortality in experimentally induced mouse typhoid epidemics (E. S. R., 48, p. 83). This curve is a close parallel to the experimental epidemic curve as reported by Amoss, and this similarity is thought to afford an explanation of the course of a spontaneously occurring epidemic of mouse typhoid. "Under circumstances in which the entire mouse population is so exposed as to be in direct contact with an infecting dose of the mouse typhoid bacillus, the nature of the resulting mortality curve depends upon the quality of susceptibility of the individuals composing the population."

Notes on blackleg immunization, J. P. SCOTT (*North Amer. Vet., 4 (1923), No. 5, pp. 269, 270*).—On investigating three cases of loss from blackleg following injection of blackleg filtrate, it was found that in all of the cases the animals had been vaccinated previously. In one case it was known, and in the other two cases suspected, that the previous inoculation had been with powder or spore vaccine. The deaths following the injection of the filtrate are attributed to incomplete destruction of the previously injected vaccine. It is emphasized that blackleg filtrate should not be used on cattle previously treated with powder or spore vaccine, but that if it is necessary to protect further an animal so vaccinated antiblackleg serum should be used, since this produces a passive immunity lasting from 3 to 6 weeks.

Immunity against foot-and-mouth disease, H. VALLÉE and H. CARRÉ (*Rev. Gén. Méd. Vét., 31 (1922), No. 366, pp. 313–317*).—This is a brief review of observations, previously noted from another source (E. S. R., 47, p. 680), which suggest the idea of the plurality of foot-and-mouth disease virus.

Nonspecific cutaneous reactions in tuberculosis, E. SIGNORELLI and E. BUFALINI (*Bol. Ist. Sierotera. Milan., 2 (1922), No. 5, pp. 253–260*).—As the result of intracutaneous tests conducted with tuberculin and with cholera vaccine on 50 hospital patients, including 19 suspected of tuberculosis, the author concludes that, while the tuberculin reaction is specific and more intense than the reaction with a foreign substance such as the cholera vaccine, the skin of tuberculous individuals reacts positively to the nonspecific substance. The conjunctival test is given only by the specific protein tuberculin. It is thought that in cases where active tuberculin is unavailable, other proteins may be used for the tuberculin test.

The extent of tuberculosis in live stock in the United States and progress in its suppression, J. A. KIERNAN (*Internatl. Assoc. Dairy and Milk Insp. Ann. Rpt., 11 (1922), pp. 207–225*).—This is essentially a review of the work accomplished by the Tuberculosis Eradication Division of the Bureau of Animal Industry, U. S. D. A., since its organization in 1917.

The colostrum problem and its solution, A. C. Ragsdale and S. Brody (*Jour. Dairy Sci., 6 (1923), No. 2, pp. 137–144, fig. 1*).—The authors discuss the fundamental differences between colostrum and milk, emphasizing particularly the large globulin and immune body content of the former and the important part which these substances play in the nutrition of the young animal. It is thought that the problem of feeding calves of tuberculosis-infected cows can be solved by pasteurizing the colostrum. Data, some of which have been reported from other sources (E. S. R., 48, p. 671), are presented, indicating that if the colostrum is pasteurized on a water bath at 145° F. for 20 minutes, or preferably at 140° for 30 minutes, its physical and immunological properties remain unaltered. Of 32 calves receiving pasteurized colostrum only 2 died, while of 22 calves in the same herd which received no colostrum but were fed normal raw milk 7 died, giving a mortality of 6 and 32 per cent, respectively. Growth curves of 5 calves from the same herd, 3 of which were fed pasteurized colostrum and 2 which were nursed, are also shown. No significant differences in growth are apparent.

Second preliminary report on parasites found in ruminants at the municipal abattoir, Baton Rouge, La., G. Dikmans (*Louisiana Stas. Bul. 186 (1923), pp. 3–12*).—In continuation of studies previously noted (E. S. R., 46, p. 281), the author has confirmed the findings of Ransom, previously noted (E. S. R., 25, p. 387), with the following additions:

"*Haemonchus similis*, a new stomach worm of cattle discovered and described by Dr. Lauro Travassos, in Brazil, has been found in Louisiana cattle. *Cooperia pectinata*, reported as a parasite of cattle, has been found in sheep. *C. punctata* reported as a parasite of cattle, has been found in sheep—two new records. *C. curticei*, reported as a parasite of sheep, has been found in cattle—a new record. One species of Trichostrongylus and one of Strongyloides, not previously reported from cattle in the United States, have apparently been found as parasites of cattle during this investigation. These last two, however, will require more detailed study for confirmation."

The habronemas and habronemoses of equines, A. Railliet (*Rec. Méd. Vét., 99 (1923), No. 3, pp. 65–81*).—This is a summary of information on *Habronema megastomum*, *H. microstomum*, and *H. muscae*, presented in connection with a list of 28 references to the literature.

On the infectious abortion of mares in Kamikita district, Aomori Prefecture, Japan, N. Kii, S. Sato, Y. Nakamura, and K. Taguchi (*Jour. Japan. Soc. Vet. Sci., 2 (1923), No. 1, pp. 27–60, pl. 1*).—The authors find that infectious abortion of mares in Japan, which often occurs epizootically and may also occur sporadically without infecting even the nearest pregnant mares, is due to *Bacterium abortus equi*. A list is given of 24 references to the literature.

Colic, J. Bagué (*Porto Rico Dept. Agr. and Labor Sta. Circ. 70 (1922), Spanish ed., pp. 7*).—A brief popular account of the several forms of colic.

An outbreak of hemorrhagic septicemia in sheep, I. E. Newsom and F. Cross (*Jour. Amer. Vet. Med. Assoc., 62 (1923), No. 6, pp. 759–762*).—This is a report upon an outbreak of hemorrhagic septicemia in sheep shipped from Sweet Grass, Mont., to Fort Collins, Colo., in which 116 out of 3,000 succumbed. Pure cultures of *Pasteurella oviseptica* were obtained.

Parasitic gastritis or "drying" in lambs, H. G. Bowes (*Univ. Leeds and Yorkshire Council Agr. Ed. [Pamphlet] 127 (1923), pp. 11*).—This is a popular summary of information on the affection, which has been for many years recognized as one of the most serious causes of loss among lambs in the Craven district of Yorkshire, England.

Further study of a parasite found in the ligamentum nuchae of equines, E. A. CASLICK (*N. Y. State Vet. Col. Rpt. 1921–22, pp. 162–167, pl. 1*).—This is a brief account of a nematode resembling *Oncocerca cervicalis*, which has been found in the ligamentum nuchae of equines. Its life cycle is unknown.

Enteromesenteric bullular emphysema of swine, U. MELLO and D. GIOVINE (*Rév. Gén. Vét., 31 (1922), No. 367, pp. 377–396, figs. 4*).—This affection of swine is said to be confined almost exclusively to individuals fed upon residues from the dairy. The lesion is generally localized in the small intestine, particularly at the union of the jejunum and the ileum, very rarely extending to the caecum, and it has never been found to involve the stomach. The formation of gas depends upon the fermentation produced through the action of certain intestinal bacteria, and particularly of *Bacillus aerogenes lactis*, on the carbohydrates and principally the lactose. The gas produced in the intestine is absorbed with the chyle. A list is given of 32 references to the literature.

RURAL ENGINEERING.

Farm mechanics, F. D. CRAWSHAW and E. W. LEHMANN (*Peoria, Ill.: Manual Arts Press, 1922, pp. 423, figs. 408*).—This book has been prepared as a textbook on the mechanical processes commonly taught in agricultural high schools and colleges and in industrial schools. It is also intended as a reference and instruction book on the farm. It is divided into main parts on woodworking, cement and concrete, blacksmithing, sheet-metal work, farm-machinery repair and adjustment, belts and belting, farm-home lighting and sanitary equipment, and rope and harness work on the farm.

Analytical mechanics for engineers, F. B. SEELY and N. E. ENSIGN (*New York: John Wiley & Sons, Inc.; London: Chapman & Hall, Ltd., 1921, pp. XIV+486, figs. 454*).—This book, in three parts, presents those principles of mechanics which are believed to be essential for engineers. Part 1 on statics contains chapters on fundamental conceptions and definitions; resultants of force systems; equilibrium of force systems; friction; first moments and centroids; and second moment, moment of inertia. Part 2 on kinematics contains chapters on motion of a particle and motion of rigid bodies. Part 3 on kinetics contains chapters on force, mass, and acceleration; work and energy; and impulse and momentum.

Irrigation investigations [at the Irrigation Substation], R. P. BEAN (*Washington Col. Sta. Bul. 175 (1922), pp. 54–59, figs. 2*).—Data from soil moisture studies in their relation to methods and amount of application of irrigation water are graphically presented and discussed. The soil moisture studies were conducted principally in connection with border experiments, and soil samples were taken immediately before and 48 hours after irrigation. It was found that, generally speaking, most of the moisture was held in the first 4 ft. Only under exceptional heavy irrigation did the samples show any pronounced increase in the fifth and sixth foot. The average results of moisture studies of 670 soil samples are summarized.

The results of a percolation test to ascertain the rates of vertical and lateral distribution of moisture indicated that the lateral movement is very uniform, and that under the conditions of the experiment a 24-hour run is sufficient for the irrigation moisture to meet the old moisture in a downward direction and also to meet the moisture in a furrow 36 in. away.

Report of the Water Conservation and Irrigation Commission for the year ended June 30, 1922 (*N. S. Wales Water Conserv. and Irrig. Comn. Rpt., 1922, pp. 54, pls. 3*).—A report for the year ended June 30, 1922.

Formulas for calculating friction heads in water pipes, F. E. GIESECKE (*Heating and Ventilating Mag., 20 (1923), No. 3, pp. 33–36, figs. 4*).—As the

result of studies conducted at the University of Texas, deficiencies in the formulas commonly used for calculating friction heads in water pipes are pointed out and suggestions made as to how they should be modified to fit actual conditions.

An outlet drain for every farm, E. R. JONES and O. R. ZEASMAN (*Wisconsin Sta. Bul. 351 (1922), pp. 55, figs. 22*).—Brief, popular information on outlet drains for Wisconsin farms is presented in this bulletin.

Progress in water purification, A. C. HOUSTON (*Surveyor and Munic. and County Engin., 62 (1922), No. 1615, pp. 407–410, figs. 11*).—A brief review is given of recent progress in water purification by filtration, storage, and sterilization.

The influence of minute quantities of metallic salts in water on its bacteriological content, E. L. ATKINSON and R. C. FREDERICK (*Jour. Roy. Naval Med. Serv., 7 (1921), No. 1, pp. 123–128*).—Studies of the effect of salts of lead, copper, iron, and zinc on the results of bacteriological analyses of water are briefly reported, indicating that copper and sometimes zinc compounds may have a very marked effect on the results of a bacteriological examination of water to determine its potability.

The results further showed that when some of these metallic salts are present in minute quantities bacteriological examinations of water may be erroneous even in cases of very serious excretal contamination, and that any water which is unfit for drinking and contains these salts may be passed as bacteriologically of good quality. The results are also taken to emphasize the importance of chemical analyses of any sample of water.

Progress of Canadian highway construction, A. W. CAMPBELL (*Canada Dept. Railways and Canals, Highways Branch Bul. 2 (1922), pp. 23, figs. 2*).—This is the report of the chief commissioner of highways of Canada for the fiscal year ended March 31, 1922.

Inundation methods for measurements of sand in making concrete, G. A. SMITH and W. A. SLATER (*Engin. and Contract., Buildings, 59 (1923), No. 3, pp. 713–722, figs. 6*).—Investigations conducted at the U. S. Bureau of Standards on the development of the principles of a proposed method of accurate field measurements of sand and water for concrete are reported.

The results indicated that when sand is measured in water the quantity of sand per unit of volume is almost constant regardless of the original water content of the sand, and that the water filling the voids in the sand is also nearly constant for any given method of placing. Shoveling of the sand into the water gave more nearly constant quantities of sand and water per unit of volume than any other method used.

The screening method gave slightly larger quantities of sand and slightly smaller quantities of water per unit of volume than did the shoveling method, and indicated a lower percentage of air voids than either the shoveling or the rodding methods. Rodding of the sand in water gave a larger quantity of sand per unit of volume than any other method used.

Placing the dry and the wet sands according to the standard methods of the American Society for Testing Materials gave quantities of sand per unit of volume slightly less than when the sand was rodded after shoveling it into the water. The quantity of sand obtained when moist sand was rodded in air was much less than when it was rodded in water. It is though that the inundation method of measurement, when used with a predetermined apparent specific gravity, may afford a convenient means of determining the proportion of sand to other concrete materials, even for jobs on which the materials are being measured by other methods.

The variation in surface water per cubic foot of coarse aggregate was approximately proportional to the variation in the fineness modulus of the coarse aggregate. The quantity of surface water was considerably greater for crushed trap rock than for quartz pebbles, and averaged about 9 per cent of the total water used in the concretes tested, or about 8 per cent by volume of the cement. The quantity of absorbed water per cubic feet was greater for quartz pebbles than for crushed trap, and was independent of the fineness modulus.

The strengths of concretes made with quartz sand measured in water were nearly the same regardless of the condition of the sand, and method of placing it, and the proportion of fine to course aggregate. The use of a constant water-cement ratio for the concrete, together with a constant fineness modulus for the mixed aggregate, resulted in a nearly constant strength regardless of the proportion of fine to course aggregate in the mix.

The use of a constant fineness modulus did not result in a constant slump or flow of the concrete. The variation in each was approximately proportional to the variation in the fineness modulus of the fine aggregate in the mix. The weight of the concrete per cubic foot and the volume yield of concrete per barrel of cement were practically constant.

Integral waterproofings for concrete, A. H. WHITE (*Indus. and Engin. Chem., 15 (1923), No. 2, pp. 150–153, figs. 8*).—Studies conducted at the University of Michigan on the properties of concrete and of integral waterproofings used where the concrete is frequently dry are reported. Observations were made on blocks 4 by 4 by 6 in., made from a single lot of sand and with cement from well-recognized commercial brands. The blocks were all made from a 1:3 mix with about 10 per cent of water. The waterproofing materials used included hydrated lime, clay, petroleum residues, and insoluble soaps.

It is noted that the three blocks waterproofed with the insoluble soaps and with petroleum showed roughly only half the absorption of the plain mortar. This in turn made a distinctly better showing than the blocks containing hydrated lime or clay.

Further studies on the influence of integral waterproofing on the strength of concrete did not warrant the consideration of hydrated lime or clay as waterproofing agents. Studies with seven waterproofing compounds containing insoluble soaps and variable amounts of fatty acid indicated that in some cases, after certain periods of time, mortars containing small amounts of insoluble soaps showed higher strengths than the plain mortar.

Power alcohol: Its production and utilization, G. W. MONIER-WILLIAMS (*London: Henry Frowde and Hodder & Stoughton, 1922, pp. XII+323, figs. 48*).—This book, a number of the Oxford Technical Publications, presents the arguments for and against the use of alcohol as a motor fuel, together with the theoretical and practical considerations governing its production and utilization. It contains chapters on the motor fuel question, the plant as a source of alcohol, production of alcohol from starch and sugar, the economics of alcohol production from crops, alcohol from cellulose materials, synthetic alcohol, excise supervision and denaturation, outline of the principles of the internal-combustion engine, the chemical and physical properties of alcohol from the motor fuel standpoint, results of engine tests, and fuel mixtures containing alcohol.

Swoope's lessons in practical electricity, H. N. STILLMAN and E. HAUSMANN (*New York: D. Van Nostrand Co., 1922, 16. ed., rev. and enl., pp. XIII+625, figs. 488*).—This is the sixteenth revised and enlarged edition of this elementary handbook of practical electricity, the original of which was written by C. W. Swoope.

A study of side draft and tractor hitches, A. H. HOFFMAN (*California Sta. Bul. 349 (1922), pp. 113–163, figs. 78*).—A detailed analysis of the factors influencing and involved in side draft occurring with certain tractor hitches is presented in this bulletin, together with the results of a number of tests to confirm the analysis.

It is shown that side draft is subject to all of the laws of mechanics that apply to forces in general, and is always present if the resisting force of the implement pulls to one side instead of parallel to the direction of motion of the tractor. It is stated that no hitch, patented or otherwise, can prevent side draft when the center lines of pull of the tractor and of the resistance of the implement are offset, and the hitch is to the center of a symmetrically placed drawbar.

Side draft may be reduced by making the total pull required and the offset angle as small as possible. It was also possible to remove all side draft from the tractor and implement by offsetting the hitch on the tractor drawbar so that the pull was straight forward from the implement. This procedure, however, caused unequal loading of the tractor drivers.

A bibliography is appended.

A self-mixing dusting machine for applying dry insecticides and fungicides, R. E. SMITH and J. P. MARTIN (*California Sta. Bul. 357 (1923), pp. 497–505, figs. 3*).—This self-mixing dusting machine is briefly described and illustrated diagrammatically and otherwise. Information on its operation and use is also given.

A study of the plasticity of paint, E. C. BINGHAM, H. D. BRUCE, and M. O. WOLBACH, JR. (*Jour. Franklin Inst. 195 (1923), No. 3, pp. 303–317, figs. 2*).—Studies with suspensions made up from white lithopone and pure acid-refined linseed oil are reported.

The results indicated that suspensions as well as the emulsoid type of colloids show the properties of plastic materials even at very low concentrations of the disperse phase. The viscosity, as ordinarily measured, was not a constant but a function of the shearing stress. At high concentrations the relation of yield value to concentration was found to be linear and the material truly plastic, while at lower concentrations the relation was not linear and the material was considered to be pseudoplastic.

It seemed possible to distinguish sharply between the plastic and pseudoplastic condition. With lithopone suspended in linseed oil, the transition occurred in a mixture containing 14 per cent of lithopone by volume. It is thought that this concentration may be related to important properties of the material, such as the fineness of structure, adhesion between the particles, etc.

The mobility-concentration curve was linear. This is taken to indicate the possibility, by measuring the plasticity of a paint and of one other paint obtained from the first by thinning, of predicting the plasticity of any paint made by thinning, provided the plasticity correction for the pseudoplastic paints is neglected.

At 45.6 per cent by volume of lithopone, the mobility would have a zero value. This concentration of zero mobility seemed to be simply connected with the pore space of the material, and is thought to have considerable significance in determining the flow of dispersions.

Dutch barns and covered yards, H. P. G. MAULE and A. E. ASTON (*Jour. Min. Agr. [Gt. Brit.], 29 (1923), No. 11, pp. 979–984, pls. 2, fig. 1*).—Information on Dutch barns and covered yards, accompanied by detailed drawings of designs for timber Dutch barns and timber-covered yards, is presented.

Portable colony brooder house, J. H. WOOD and A. F. GANNON (*Ga. Agr. Col. Circ. 92 (1923), pp. 4, figs. 3*).—Drawings and a bill of materials for a 250-chick portable colony brooder house are presented.

Portable brooder and growing house, R. S. Wooster (*Ga. Agr. Col. Circ. 93 (1923), pp. 4, figs. 4*).—Drawings and a bill of materials for a 500-chick brooder and growing house are presented.

The Missouri colony brooder house, H. L. Kempster (*Missouri Sta. Circ. 110 (1923), pp. 2, figs. 3*).—This house is briefly described and illustrated and a bill of materials presented.

A homemade trap nest (*Ga. Agr. Col. Circ. 91 (1923), pp. 4, figs. 4*).—Information on the construction of a homemade trap nest, accompanied by detailed and working drawings, is presented.

Investigation of warm-air furnaces and heating systems, A. C. Willard, A. P. Kratz, and V. S. Day (*Ill. Univ., Engin. Expt. Sta. Bul. 120 (1921), pp. 145, figs. 50*).—This is a progress report of the work on warm-air furnace research which is being conducted by the University of Illinois, in cooperation with the National Warm-Air Heating and Ventilating Association.

A rather detailed description of the extensive apparatus and of the more important features thereof is first given, and graphic data on tests of piped and pipeless furnace plants are presented. This is followed by a detailed discussion of methods of testing, precise measurement, and general procedure which are in process of development, together with some of the results obtained to date. The studies of piped furnaces have so far shown that the design of a furnace heating system must be based on the British thermal unit loss per hour from each room.

Studies of 12 pipeless furnaces showed the relations between and the importance in design of the rate of combustion, efficiency, capacity in British thermal units per hour, equivalent register temperature of the air leaving the register based upon 65° F. inlet temperature, and draft in inches of water. It is shown that capacity is entirely dependent upon draft for a given furnace and a given coal, and that high capacity is sometimes attained at a loss in efficiency. It was further found that the slotted fire pot should not be used with hard coal as fuel. In studies of casings for pipeless furnaces the best results were obtained with a furnace having a double inner casing with a 1-in. air space. The proper height from the floor for the bottom of the inner casing was found to be from 7 to 9 in.

In proportioning the registers for a pipeless furnace, a logical rule seems to be that the mean between the warm-air throat area and the free area of the warm-air register face should be equal to the minimum free area of the warm-air space across the inner casing.

Studies of heat losses from a pipeless furnace showed that of the total loss 48.3 per cent was lost from the furnace front, 26.5 per cent from the concrete floor, 7.05 per cent from the lower casing below the shield, and 18.15 per cent from the upper casing.

Studies on the emissivity of heat from various surfaces presented very convincing evidence against the use of thin layers of asbestos paper covering on bright tin pipes. The heat loss was 62 per cent greater with one thickness of the paper covering a bright tin pipe than when the same pipe was left uncovered, which resulted in a waste of 5 per cent or more of the coal consumed. Eight thicknesses of the paper were necessary to reduce the heat loss below that from a bare, bright tin specimen.

Studies of heating surfaces in which two sets of tests with hard coal and two with soft coal were run with slots in the fire pots closed and open, showed that for any particular furnace and for a given temperature rise, all other conditions remaining the same, the castings will give off a greater amount of heat in a unit time for a hard coal fire and a fire pot with slots closed than they will

for a hard coal fire with the slots open or for soft coal fires under any conditions.

Preliminary studies on the effect of increasing the velocity of the air over the heating surfaces showed that by using a fan and positive circulation it appeared possible to increase the capacity of a pipeless furnace to from two to three times the capacity on natural circulation. A comparison of fire pots with open and closed slots showed that, in the case of a hard coal fire with the slots in the fire pot open, the capacity and efficiency were very materially reduced.

The efficiency of low temperature coke in domestic appliances, M. W. FISHENDEN ([*Gt. Brit.*] *Dept. Sci. and Indus. Research, Fuel Research Bd., Tech. Paper 3 (1921), pp. 35, figs. 10*).—A brief account is given of a series of experiments made to compare the efficiencies of coke made by a low temperature carbonization process and ordinary bituminous coal in various domestic room heating and water heating appliances. The studies included experimental determinations of the radiation from open sitting room and kitchen grates, determinations of the water heating produced in various types of boiler for domestic hot water supply, and approximate oven tests. The coal used was a soft caking bituminous coal having a calorific value of 14,700 B. t. u. per pound. Four cokes were used varying in calorific value from 11,900 to 12,900 B. t. u. per pound.

It was found that in each of three open sitting room grates of different design coke gave a considerably higher radiation efficiency than coal. The advantage of the coke over the coal in this respect was more pronounced the higher the efficiency of the grate. In all cases the coke lighted easily and produced a bright, smokeless, and very hot fire.

Similar results were obtained with kitchen ranges and water heating devices. The conclusion is drawn that for such uses the calorific value of a bituminous coal must in all cases be considered greater than that of low temperature carbonization fuel if it is to give equal results weight for weight.

The coke was found to compare somewhat less favorably with coal for oven heating, and approximately equal numbers of heat units were required to give similar results. The advantage of the coke in this case appeared to be largely due to radiation effects, and was most marked when the distance between the fuel bed and the oven was low. This advantage decreased as the distance increased, until a point was reached in some cases where the coal gave better results owing to its flame contact.

Tests of the efficiencies of kitchen ranges indicated the magnitude of the reduction in radiation efficiency which the presence of a boiler behind an open fire entails, the mean value for radiation being the equivalent of from 8 to 12 per cent of the heat units of the fuel burned. A large old-fashioned open kitchen range with an oven at one side, a hot plate at the other side, and an iron saddleback boiler behind the fire gave about 17 per cent of the heat of the coal consumed in hot water, run off at temperatures suitable for household purposes, under the most favorable conditions. The radiation amounted to about 10 per cent. Very similar results were yielded by several more modern designs of range, practical water heating at its best varying from about 13 to 19 per cent and radiation to 10 or 11 per cent. For water heating one of the ranges examined, whether modern or old-fashioned, approached the performance of an independent boiler. The example of the latter class which was selected for test gave a water-heating efficiency of more than 30 per cent for coal and more than 40 per cent for coke cakes (or, if corrected for heat losses from the

cylinder and pipes, about 36 and 46 per cent, respectively), and in addition the open fire radiation accounted for a further 7 or 8 per cent.

Soldering, F. G. BEHRENDS (*N. Y. Agr. Col. (Cornell) Ext. Bul. 57 (1923), pp. 28, figs. 18*).—This bulletin contains practical information on soldering.

RURAL ECONOMICS AND SOCIOLOGY.

Food production in war, T. H. MIDDLETON (*Oxford, Eng.: Clarendon Press; New York: Oxford Univ. Press, 1923, pp. XX+373, figs. 2*).—Chapter 1 of this volume sketches the situation of British agriculture in 1914. Chapters 2 to 5 set forth the resources of the British farmer at that time and the potential and actual food production. Succeeding chapters are devoted, respectively, to the harvests of 1915 to 1918, inclusive. Chapter 10 describes the position of agriculture at the end of the food-production campaign in 1918 and in 1919. The final ones set forth the cost of the campaign, the difficulties of transition back to farming from food production, and the numerous problems of peace-time farming. Appendixes contain some of the rules and regulations dealing with agriculture in this period.

The course of agricultural income during the last 25 years, D. FRIDAY (*Amer. Econ. Rev., 13 (1923), No. 1, Sup., pp. 147–158*).—It is the purpose of this paper to set forth statistically the course of the American farmers' income from 1897 to 1922.

In 1900 the relative prosperity of agriculture was universally conceded. Comparing the balance between farm products and all commodities which prevailed in 1922, it is found that the relation is almost precisely the same as in 1900. According to the U. S. Bureau of Labor Statistics index numbers of wholesale prices, the price situation was on the average less favorable to the farmer between 1897 and 1912 than in the years immediately preceding the war. During the years 1914 to 1922, inclusive, the index number for farm products averaged two points higher than that of all commodities. The farmer who neither bought nor sold his farm in the period since 1913 is held to have enjoyed a more favorable price situation during that time than during the 10 years from 1900 to 1909.

The output per person is estimated as fully 25 per cent higher than it was two decades ago. Taking this factor into consideration, the author holds that the income of the farmers from 1914 to 1922 was approximately one-third greater than in the decade following 1900.

The question of income is approached on the basis of the gross value of farm products based on prices at the farm. U. S. Department of Agriculture figures are given which indicate that for the decade 1900 to 1909 the total gross value of all products was on the average 66 per cent of that of 1913, while for the years 1914 to 1922, inclusive, the index was 164 per cent, and it is calculated that the real income per person has been about 30 per cent higher since 1914 than it was in the decade following 1900.

It is granted that a certain amount of financial distress has prevailed among specific groups and in certain areas.

Accumulation of wealth by farmers, L. C. GRAY (*Amer. Econ. Rev., 13 (1923), No. 1, Sup., pp. 159–178*).—This paper is presented in two parts, dealing with the net worth of farmers and the income received by the farming class. Data from the census of 1920 and farm business analysis surveys conducted by the Bureal of Agricultural Economics, U. S. D. A., are brought together under the heads of farm assets, wealth owned by farmers other than farm assets, farmers' indebtedness, their indebtedness other than that secured by real estate mortgages, net worth by classes of tenure, and the significance of net worth

as a measure of accumulation, also the source of income of the farming class and its range.

The net worth of farmers in 1920 is estimated at about $62,000,000,000, although this does not include all of the wealth saved by the farming classes in the past, the savings of farmers out of production as distinguished from wealth acquired through changes in values, nor the intangible progress achieved in the form of education and other lines of personal improvement.

The total payments made by farmers to other classes on account of rent and interest approximate about $314 per farm, and the net incomes $1,754 per farm for 1919 and $944 for 1920. The income from investments outside of farming add not more than $20 per farm family. Adding the farm laborer population to the number of farm operators and making allowances also for the wages of farm laborers, an estimate of per capita income is obtained amounting to $409 in 1919 and $244 in 1920. In 1919 approximately 70 per cent of the farmers were in groups averaging $1,716 or less, while in 1920 the same percentage fell in groups averaging $933 or less. Approximately 40 per cent belonged to groups averaging $729 or less in 1919 and $396 or less in 1920, and over one-sixth of the farm population were in groups that had average incomes of $326 or less in 1919 and $177 or less in 1920.

In general, the figures suggest that the accumulation of wealth in agriculture would be a very slow process without rigid thrift on the one hand and the fact of rising land values on the other.

[Report of the] division of farm management, G. SEVERANCE (*Washington Col. Sta. Bul. 175 (1922), pp. 27–30*).—Two studies are reported upon in detail, the first dealing with the cost of milk production and dairy farm organization as an abstract of the report of a survey which has been noted (E. S. R., 48, p. 591).

In an account of studies on cost of wheat production and grain farm organization in the Palouse, data obtained cooperatively by the Bureau of Agricultural Economics, U. S. D. A., the University of Idaho, and the Washington Station in a 3-years' study completed in the summer of 1922 are summarized. Usable records were obtained from 229 representative farms located near Pullman, Wash., and Moscow, Idaho, in 1919 and from 241 farms in 1920.

In 1919 farms operated by owners averaged 297 acres and tenant farms 312 acres, while in 1920 owners operated an average of 331 acres and tenants 334 acres. The average investment on the farms studied was, in 1919, $45,978 for farms operated by owners and $4,596 invested by tenants on tenant farms, and in 1920 $52,192 on owner farms and $4,585 on tenant farms. In 1919 owners operating their own farms made an average labor income of $1,766 and in 1920 minus $1,815. Tenants made respective yearly incomes of $2,420 and $206.

The following table gives a summary of data with reference to wheat costs:

Cost of a bushel of wheat in the Palouse.

Crop.	Kind of tenure.				Position in crop rotation.					
	Owners.		Tenants.		After fallow.		After peas.		After other crops.	
	1919	1920	1919	1920	1919	1920	1919	1920	1919	1920
Winter wheat	$1.63	$1.44	$1.40	$1.20	$1.75	$1.50	$1.18	$1.09	$1.65	$1.69
Spring wheat	1.83	1.70	1.54	1.62	.....	.....	.....	.....	.....	.....
All wheat	1.69	1.56	1.44	1.40	.....	.....	.....	.....	.....	.....

The marked difference is due principally to the fact that the cost of production was charged with 6 per cent interest on the value of the owner's capital in the case of farms operated by owners, whereas that on tenant farms was charged with the portion of the crop delivered for rent which amounted to considerably less than the 6 per cent on the landlord's investment.

A study was also made of the basic acre requirements in producing winter wheat after fallow, after peas, and after other crops.

Purchasing power of Nebraska grains, H. C. Filley and E. A. Fredericks (*Nebraska Sta. Bul. 187 (1923), pp. 35, figs. 3*).—Prices paid for grain at Columbus, Nebr., between 1877 and 1922 and the general price level as obtained from the records of the U. S. Department of Labor are compared. Corn is found to have had a low purchasing power from 1879 to 1900, and this fact is in part attributed to overproduction. It had its highest purchasing power in 1917 and its lowest in October, 1921. The purchasing power of wheat is said to have fluctuated less than that of corn. As compared with 1913, it was higher in February, 1923, than that of either corn or oats. Oats had a lower purchasing power during the last four months of 1921 than at any time in the period under consideration.

Farm costings in Ireland, J. M. Adams (*Ireland Dept. Agr. and Tech. Instr. Jour., 22 (1922), No. 3, pp. 197–273*).—Specimen sheets for recording farm accounts are reproduced, and various charges and credits are discussed. A complete set of cost accounts made up from the actual records kept by a farmer under the supervision of the agricultural costings committee for the year ended February 28, 1921, is given.

Farm bookkeeping, J. Kirkwood (*Edinburgh: W. Green & Son, Ltd., 1922, pp. 224*).—This has been designed primarily for use in the extension classes of agricultural colleges, but may at the same time serve as a handbook for farmers generally. Part 1 is devoted to a study of the double-entry system. Part 2 deals with a simple form of bookkeeping entailing the minimum amount of clerical work deemed consistent with efficiency.

The restoration of a devastated farm, E. Dutruel (*La Reconstitution d'une Ferme Dévastée. Thesis, Inst. Agr. Beauvais, 1922, pp. 89, fig. 1*).—This thesis, submitted in 1922 at the Agricultural Institute of Beauvais, is a description of the history, layout, and stock of a farm of 90 hectares (222 acres), 65 of which are in cultivation and 15 in natural meadow, which is situated at Frelinghien (Nord), France. It was completely devastated during the war, and it is shown here how much has been accomplished since 1918 in the way of restoration. Suggestions are made as to future procedure and what may be expected in the way of a return to pre-war productivity.

An account of the activity of the People's Commissariat of Agriculture for the years 1917 to 1920, B. N. Knipovitch (*Ocherk Deiatel'nosti Narodnogo Komissariata Zemledeliia, 1917–1920. [Moscow: Gort.], 1920, pp. 47*).—The land of Russia was declared the property of the State in 1917, and the peasants took possession between 1917 and 1919. The number of relatively large peasant farms of from 17 to 27 acres decreased, while that of small and middle-sized farms of 3 to 17 acres increased. Very perceptible negative results are noted in that the large progressive farms which were supplying the market were destroyed, and the supply of agricultural machinery, seeds, fertilizers, and live stock has decreased. A total number of 16,000 persons were found at the beginning of 1919 who had had an agricultural education. Between 1918 and 1920 77 new agricultural schools were opened.

The Agricultural Credits Act of 1923, G. C. Henderson (*Quart. Jour. Econ., 37 (1923), No. 3, pp. 518–522*).—The provisions of the five sections of this act are briefly set forth, with comment.

Handling the farmer's grain, F. R. DURANT (*Minneapolis: [Author], 1922, pp. 31, figs. 12*).—Types of elevators are described as farmers' elevators owned by an organized stock company and those owned by farmers cooperatively, independent elevators, line elevators controlled from one central point under one management, and mill elevators under one management used as a source of supply for some milling company. There are said to be in the four northwestern States approximately 5,600 elevators of all these types, a little over 50 per cent being farmers' or independent. The average capacity is about 28,000 bu. each and the average number of bins 11. Methods of receiving, grading, selling, and shipping grain are described in detail.

Fifty years of farmers' elevators in Iowa, E. G. NOURSE (*Iowa Sta. Bul. 211 (1923), pp. 233–271, figs. 10*).—Three farmers' elevator movements in Iowa are defined, the first one that identified with the development of the Grange after 1868, the second growing up in the eighties with the Farmers' Alliance, and the third beginning in 1904 with the winning of the organized opposition to the line elevator system.

From 1904 to 1920, inclusive, 524 farmer elevators were organized. In 1921 there existed 511, scattered quite generally over the whole State, but distributed more sparsely in the eastern and southern counties, which have a limited grain surplus. Webster County leads in numbers with 17 elevators, Calhoun has 16, Kossuth 14, and Sioux 12. It is indicated that about 32.6 per cent of all the elevators in the State are in farmers' hands and that about 41 per cent of the grain business is conducted by farmers' companies. The handling of farm supplies and of live stock make up together nearly one-third of the total value of goods handled by 207 elevator companies.

Data are given showing the capitalization and the value of the property held by the companies. The permanence and value of the farmers' elevator movement are held to be now accepted, yet the present is deemed a critical period, because of the generally disturbed financial and commercial situation which has prevailed, because the enthusiasm and determination of earlier years are somewhat abated, and because of the attempt to pass from local grain shipping to terminal grain selling. Certain needs in the way of the reawakening of local sentiment and interest, the reorganization of the whole scheme of elevator management for maximum efficiency and economy, more expert management, and attention to orderly marketing are pointed out.

The marketing of Kentucky strawberries, O. B. JESNESS and D. G. CARD (*Kentucky Sta. Bul. 246 (1923), pp. 3–30, figs. 4*).—Marketing organizations and methods are described, and the principal outlets, competitors, prices, and expenses in marketing Kentucky strawberries are briefly set forth. The importance of locating promptly sufficient outlets is emphasized. Statistics indicate the dependence of the Kentucky strawberry growers upon the larger cities as markets, and it is urged that a united State advertising campaign be carried on in order to extend the market. Federation among local organizations and better transportation and refrigeration facilities are deemed the more urgent needs of the present.

Cooperative live stock shipping associations in Missouri, R. LOOMIS (*Missouri Sta. Bul. 199 (1923), pp. 3–10*).—Estimates received from various sources indicate that even as early as 1920 from 25 to 30 per cent of the shipments received at Missouri's primary markets were cooperative shipments. The highest percentage in any class of live stock is for hogs and the lowest for cattle, due to the fact that cattle are more often fed in car lots.

Data taken from the records of several of the oldest cooperative live stock shipping associations are tabulated here to show the extent of the business costs and savings. A shipping margin of 58, 70, and 79 cts. per 100 lbs. is

computed on the marketing of hogs from a certain point to three markets 91, 112, and 242 miles distant, respectively. Similar data for cattle are 70, 67, and 69 cts. and for sheep shipped to the two nearest markets are $1.43 and $1.49, respectively. At the local point from which this information was collected it was claimed that private buyers were asking a margin of from $1 to $3 on all classes of live stock. According to the figures given here this shipping margin would be justifiable only in the case of sheep, where the margin was about $1.50.

Several associations claimed to have made savings of from $20 to more than $100 per car. Some organizations, estimating their savings on the basis of 100-lb. lots, estimate them to have varied from 25 cts. to $1 per 100 lbs. It is concluded that the man producing less than a carload of live stock is very materially benefited, either directly or indirectly, by a cooperative shipping association.

Some aspects of agricultural marketing as illustrated by the Lyallpur cooperative commission sale shops, H. K. Trevaskis (*Agr. Jour. India, 18 (1923), No. 2, pp. 115–131*).—Marketing problems in France, England, and India are briefly mentioned. It is pointed out that financial support is everywhere essential, but that in India it is especially so owing to the widespread indebtedness of the agricultural population. The financial arrangements of the commission shops described are said to have resulted in a threefold increase of business and the liberation of the grower from the necessity of forced sales at inadequate prices. Grading and transportation problems are being effectively worked out.

Weather, Crops, and Markets (*U. S. Dept. Agr. Weather, Crops, and Markets, 3 (1923), Nos. 14, pp. 305–328, figs. 3; 15, pp. 329–368, figs. 8; 16, pp. 369–392, figs. 2; 17, pp. 393–416, figs. 2*).—Temperature and precipitation charts are presented for the weeks ended April 3, 10, 17, and 24, 1923, with general and weekly summaries of weather conditions. There appear also the usual tabulated weekly and monthly reports and special articles pertaining to receipts and prices of important classes of crops and live stock and the position in the market of specific commodities.

Crop reports in No. 14 cover forecasts of production of certain early vegetables; stocks of wheat in country mills and elevators, March 1, 1918, to 1923; farm value of certain crops per acre, 1922, with comparisons; and a brief note on the poultry production of the United States. No. 15 contains tabulations with interpretative comment setting forth the winter wheat condition as of April 1, 1923; farm labor supply and demand; and the number of breeding sows on farms, together with reports on the production of certain commercial truck crops, the production of important crops in the five leading States, and the usual farm value tables. Brief articles are given discussing the new Agricultural Credits Act and setting forth the production of hops in England. Reviews of the world corn and oats production for the crop year 1922–23 are given in No. 16. Reports of special investigations with reference to farmers' intended plantings of the principal spring planted crops, the movement of southern negro farmers to northern industries, returns to farm owner operators in 1922, and the decrease in the agricultural population in rural areas of the United States are presented in No. 17, as well as a report of the committee called to consider the agricultural outlook and to prepare a statement providing a basis upon which real adjustments to meet the economic situation may be made by agricultural producers.

Farmers' Market Bulletin (*North Carolina Sta. Farmers' Market Bul., 10 (1923), No. 61, pp. 8*).—This contains the usual partial list of products which farmers have for sale.

The bank agricultural department, R. A. WARD (*New York: Bankers' Pub. Co., 1923, pp. VI+7–137, figs. 6*).—The qualifications of a bank agriculturist are set forth here, and a program of work for the agricultural department of a country bank is outlined to include the making of an agricultural survey, projects for increasing crop production and the improvement of live stock, boys' and girls' agricultural clubs, and advertising and publicity activities.

Uncle Reuben in Washington, C. S. BARRETT (*Washington: Farmers' Natl. Pub. Co., Inc., 1923, pp. 218, pl. 1*).—In these pages are recounted some of the experiences of farmers' organizations with politics and legislation.

The challenge of agriculture, edited by M. H. STAPLES (*Toronto: George N. Morang, 1921, pp. 197*).—The organization in 1914 and the development of the United Farmers of Ontario are set forth in these pages. Certain activities, such as cooperative and publishing companies, women's clubs, and political activities, are described.

Lectures on the Industrial Revolution of the eighteenth century in England, A. TOYNBEE (*London and New York: Longmans, Green & Co., 1923, pp. XXXV+282*).—This is a reprint of the third edition, issued in 1908, of lectures delivered at Oxford between October, 1881, and May, 1882, dealing with the Industrial Revolution in England in 1760, England in the midst of the revolution, and England at the time of the establishment of peace. The works of Adam Smith, Malthus, and Ricardo are analyzed as bearing, respectively, upon these three periods, and the position of agriculture and agricultural wage earners is discussed. An appreciation of the author is presented as an introduction by Lord Milner. Popular addresses, notes, and other fragments are included at the end of the volume.

[Algerian agriculture], V. DEMONTÈS (In *Renseignements sur l'Algérie Économique. Paris: Off. Gouvt. Gen. Algérie, 1922, pp. 1–116*).—This is a description of geographical and climatic conditions found in Algeria, as well as of cultivated and natural soil products, and live stock.

The trend of agricultural development in the United Provinces, H. M. LEAKE (*Agr. Jour. India, 18 (1923), No. 1, pp. 10–22*).—The prime need of agriculture in this region is held to be the control of the water supply, and the possibilities of developing this from various sources, but principally from wells, and the types of power available for lifting the water are discussed, as is also the possibility of an economic organization between zemindars and tenants for providing capital for agricultural improvements.

Communities, associate and federate, D. SNEDDEN (*Amer. Jour. Sociol. 28 (1923), No. 6, pp. 681–693*).—Indeterminate conceptions of the application of the term community are held to be provocative of much confusion in programs of rural and urban reconstruction. Many kinds of communities exist, and civilized man is a member of many rather than only one. Many social functions, such as common defense, fire protection, relief of sudden distress, and ameliorations of living by means of good roads, schools, health services, money lending, and merchandising, are now effectively and unconsciously carried on by impersonal organized communities described as federate. Others are as yet inadequately provided for, and the rural dweller is said to suffer most of all from a lack of community fellowship. It is urged, however, that the existence of mechanized and unconscious cooperation be not overlooked, and that "it must be the gigantic task of the new social, and especially civic, education to prepare the rising generation to function effectively in the larger communities."

Community Life Campaign, April 23–May 20, 1922 ([*Richmond, Va.: State Council of Rural Agencies, 1922*], *pp. 49*).—The origin, methods, and purpose of the state-wide Community Life Campaign conducted in Virginia are

set forth here, and excerpts from addresses and reports are given, together with outlines, suggestions, and information regarding numerous rural agencies, compiled for the use of workers in the campaign.

Statistical information with regard to the beef trade.—I, The British market, R. PREBISCH (*Información Estadística Sobre el Comercio de Carnes.—I, El Mercado Británico. Buenos Aires: Soc. Rural Argentina, Ofic. Estadís., 1922, pp. 75, pls. 2, figs. 10*).—This is a compilation of statistical material, tabulated and presented graphically, showing the kinds and amounts of chilled and frozen beef exported to Great Britain from South American countries, particularly Argentina, through a period of years.

[Agricultural statistics for the Netherlands] (*Jaarc. Konink. Nederlanden, Rijk Europa, 1921, pp. 190–199*).—These pages add statistics for 1921 to the series of annual reports previously noted (E. S. R., 47, p. 96).

[Agriculture and agricultural losses in Latvia] (In *Latvia: Actual Conditions and Possibilities in One of the Baltic Republics. Riga: Gort., 1922, pp. 38–43, 58–61*).—Agricultural and live stock industries are briefly noted in portions of this handbook, compiled for the Latvian Delegation to the Genoa Conference and published in English and French.

Annual agricultural statistics for 1920 (*Statis. Agr. Ann. [France], 1920, pp. 152*).—This annual statistical report for France continues the series previously noted (E. S. R., 45, p. 597) by adding statistics for the later year.

The foreign trade in agricultural products in 1922, H. and J. HITIER (*Expansion Econ., 7 (1923), No. 3, pp. 4–13*).—A résumé is given of the annual statistics for 1922 published by the French minister of finances, setting forth the imports and exports of agricultural products. A notable diminution in the importation of cereals, particularly wheat, and of meats is noted. A decided falling off in wine exports and the failure of others to reach pre-war figures are pointed out. Cane sugar is said to have taken the most important position of all the items in the foreign trade.

AGRICULTURAL EDUCATION.

Rural life and education, E. P. CUBBERLEY (*Boston: Houghton Mifflin Co., 1922, [2. ed.], rev. and enl. pp. XV+377, pls. 31, figs. 75*).—The volume previously noted (E. S. R., 31, p. 193) has undergone complete revision, some of the chapters being rewritten, old data brought up to date, and some new textual matter and a number of new maps and pictures added.

The organization of the one-teacher school, E. A. LATHROP (*U. S. Bur. Ed., Rural School Leaflet 10 (1923), pp. 12*).—The more important methods by which the number of classes in a one-teacher rural school may be reduced, such as grade grouping, correlation of subject matter, alternation of subjects, and alternation of grades, are set forth briefly. Summarizations of suggestions for the alternation of grades are given from the courses of study of Illinois, Missouri, and Montana. It is deemed unwise for the teacher on her own initiative to attempt the alternation of two consecutive years of work as outlined in the course of study without the help and consent of the county superintendent or other supervisory officers.

The organization of a rural demonstration school, held in connection with a course in rural education offered during the summer session of Johns Hopkins University, is discussed. This school was composed of 21 children from rural Maryland, ranging in ages from 6 to 13 and representing grades 1 to 7, inclusive. Educational and physiological tests were given, and the school was then organized into 4 groups, group 1 made up of grade 1, group 2 of grade 2, group 3 of grades 3 and 4, and group 4 of grades 5, 6, and 7. It was deman-

strated that for this number of children the number of daily classes could be reduced to 20 and still meet the requirements for subject matter as outlined in the course of study for each of the 7 grades. The daily program is given.

A daily program taken from a publication issued by the State Department of Illinois is also given, together with some references on the organization of the one-teacher school.

Facts about College of Agriculture, University of Arkansas (*Arkansas [Sta.] Bul. 182 (1922), pp. 31, figs. 24*).—This publication describes the property and equipment of the college, the cost of an agricultural course there, and station and extension activities.

Teaching horticultural manufactures, W. W. Chenoweth (*Amer. Soc. Hort. Sci. Proc., 19 (1922), pp. 43–48*).—Preliminary training in bacteriology, chemistry, physics, and agricultural economics is deemed essential for a course in food preservation. The work must be largely laboratory and must be given according to the fruits or vegetables that are in season. A brief suggetive outline of a general course, including a fall term of 2 lectures and 3 2-hour laboratory exercises, a winter term of 1 lecture and 2 2-hour laboratory periods, and a third term of 2 2-hour laboratory periods per week, is given.

Feeding young live stock, L. Stevenson (*Ontario Dept. Agr. Bul. 293 (1923), pp. 24, figs. 10*).—This circular for boys' and girls' clubs is limited in scope to the feeding and care of calves, colts, lambs, and pigs. Some tables are given setting forth feed requirements of young animals.

Pigeon raising, A. Macleod (*New York: Macmillan Co., 1923, pp. 113, figs. 2*).—This is a general manual prepared for those interested in pigeon raising as a vocational project.

The community plan for junior extension work, C. W. Buckler (*Ky. Agr. Col. Ext. Circ. 136 (1922), pp. 32, fig. 1*).—Blanks are given on which to keep records and schedules of plans.

Outline of organization of junior extension clubs, C. B. Wadleigh (*N. H. Agr. Col. Ext. Circ. 55 (1923), pp. 11*).—This circular has been prepared as a guide and outline to new or prospective local leaders.

Organization of calf clubs, N. Pearson (*Mich. Agr. Col., Ext. Club Bul. 14 (1923), pp. 11, figs. 6*).—This outline of a plan of organization is applicable either to beef or dairy clubs.

Supervised practical work for boarding students in agriculture, F. R. Philips (*School and Soc., 17 (1923), No. 430, p. 332*).—Note is made of the efforts of agricultural students in certain schools in Texas to carry on crop projects during the summer vacation and to keep farm animals on the school farm or at their boarding places.

Home demonstration work in Wyoming, M. Rokahr (*Jour. Home. Econ., 15 (1923), No. 5, pp. 259–262*).—A résumé is given of the organization and the results accomplished, with particular reference to clothing, poultry husbandry, food and nutrition, child care, better homes, and fairs and recreation.

Sewing for girls, G. Arbogast (*Wis. Agr. Col. Ext. Circ. 155 (1923), pp. 48, figs. 74*).—Directions are given for plain and decorative stitches and for the construction of several garments.

Garment making.—I, II, Mrs. J. K. Fyfer (*Missouri Agr. Col. Ext. Serv. Boys' and Girls' Club Circs. 1 (1922), pp. 51, figs. 59; 2, pp. 40, figs. 37*).—In the first circular of this series, arranged to meet the needs of boys and girls of club age, there have been compiled directions for making articles for household use. The second circular gives directions for making a number of undergarments as girls' club projects.

A brief manual of games for organized play, M. T. Speakman (*U. S. Dept. Labor, Children's Bur. Pub. 113 (1923), pp. 39, figs. 12*).—Directions for

teaching schoolroom games for younger and older children and bean bag and ball games are given, together with suggestive game programs and a list of reference books.

MISCELLANEOUS.

Biennial report of the director of the agricultural experiment station for 1921 and 1922, E. J. IDDINGS (*Idaho Sta. Circ. 30 (1923), pp. 15*).—The experimental work reported is for the most part abstracted elsewhere in this issue.

Report of the work at the Raymond Branch Experiment Station, C. B. ANDERS (*Mississippi Sta. Bul. 213 (1923), pp. 8*).—The experimental work reported is for the most part abstracted on pages 222 and 234 of this issue.

Annual report of the director for the year ending June 30, 1922, [R. L. WATTS] (*Pennsylvania Sta. Bul. 176 (1922), pp. 23*).—This bulletin discusses briefly the work of the station for the year ended June 30, 1922, including a financial statement for this period. The experimental work recorded is for the most part abstracted elsewhere in this issue.

Thirty-second Annual Report of Washington College Station, 1922, E. C. JOHNSON ET AL. (*Washington Col. Sta. Bul. 175 (1922), pp. 64, figs. 2*).—This contains the organization list, a report on the work of the station during the year, and a financial statement for the Federal funds for the fiscal year ended June 30, 1922, and the remaining funds for the fiscal year ended March 31, 1922. The experimental work reported is for the most part abstracted elsewhere in this issue.

Monthly Bulletin of the Ohio Experiment Station (*Ohio Sta. Mo. Bul., 8 (1923), No. 1–2, pp. 32, figs. 9*).—This number contains, in addition to several articles abstracted elsewhere in this issue, the following: Ornamental Planting in Development of the Small Homestead, by F. H. Ballou; Precipitated Lime, by C. E. Thorne; and Live Stock on Southeastern Ohio Farms, by S. C. Hartman.

NOTES.

Alaska College.—*Farthest North Collegian* is being issued by the students and faculty of the college. The initial number announces the establishment of a course in reindeer management, this to include visits to herds under typical range conditions.

Connecticut State Station.—The station held its annual Field Day August 7 at its Mount Carmel Farm. Dean Henry S. Graves of the Yale Forestry School delivered an address entitled Forestry in Relation to Agriculture.

The annual Field Day of the Tobacco Substation at Windsor was held July 31, with an excellent attendance and interest. Dr. George H. Chapman, physiologist in charge of this substation, has resigned to become assistant general manager of a tobacco company in Porto Rico, and has been succeeded by C. M. Slagg of the Office of Tobacco Investigations, U. S. Department of Agriculture.

M. F. Morgan, specialist in soils at Ohio State University, has been appointed investigator in soils. Work has been started on a new project designated as A Study of the Soils of Connecticut. The first field season is to be spent in developing field technique in the soil survey, which will be one phase of the investigation. An intensive study of tobacco soil problems is also to be undertaken this fall and winter.

R. C. Botsford has been appointed deputy in charge of mosquito elimination.

Florida University.—The resignations June 30 are noted of State home demonstration agent Sarah W. Partridge, assistant State home demonstration agent Harriette B. Layton, extension dairy specialist May Morse, and extension poultry specialist Minnie M. Floyd.

Kansas College.—Dr. Margaret M. Justin has been appointed dean of the division of home economics vice Dr. Helen B. Thompson, who has resigned to become professor of home economics in the University of California, southern branch, and has entered upon her duties.

Mississippi College and Station.—The college is issuing the *Mississippi Soil Improvement Journal* as the official organ of the department of soils and crops and the State Soil Improvement Association. Publication began in April as a quarterly, and the purpose is announced as to "advocate practical methods of soil improvement to the end that we may be of help to those who make their living by its cultivation." The initial number contains the constitution of the association, several articles on soil topics, excerpts, etc.

Hugh Critz, who is to have charge of the service bureau of the college, is also to be agricultural editor for the station.

Cornell University.—The new insectary was completed for occupancy June 1. The building will be used mainly for research purposes, but will also provide facilities for a course on photography and methods of rearing insects.

Porto Rico University and Federal Station.—C. M. Tucker of the College of Agriculture has been appointed pathologist in the station, beginning June 20.

South Carolina Station.—At the recent session of the legislature a bill was passed providing for the establishment of a boll weevil control station to be operated by the station in cooperation with the U. S. Department of Agriculture. The legislature appropriated $25,000 for this station, which it is expected will be supplemented by a like amount from Federal funds. Work has already been begun under the supervision of Director H. W. Barre of the station and B. R. Coad, in charge of the Delta Laboratory. The plans call for a division of boll weevil control, of which Dr. N. E. Winters has been appointed head. A staff consisting of an entomologist, an agronomist, and assistants is contem-

plated, and extensive data will be collected for use in fighting the boll weevil, not only in South Carolina but in other sections of similar climatic conditions. The station has been located at the Pee Dee Substation at Florence.

The usual State appropriation of $50,000 has been made for general experimental work.

Virginia Station.—S. A. Wingard, who has been on leave for graduate work in plant pathology at Columbia University, has resumed his duties at the station and has been promoted to the rank of associate plant pathologist. T. K. Wolfe has been promoted to the rank of agronomist. R. H. Hurt has been appointed assistant plant pathologist in charge of a field laboratory at Crozet for the investigation of the control of apple scab and other fruit diseases. J. J. Vernon has been appointed associate agricultural economist and is expected to undertake shortly a project in this field.

Wisconsin University and Station.—Of the 55 doctor's degrees conferred by the university at the recent commencement, 23 were given in the College of Agriculture. The college also received 50 of the 191 master's degrees conferred.

The summer school enrollment in agricultural courses was about 300, nearly the same as last year.

Sixty-five rural ministers and other church workers representing eleven States and nine denominations were in attendance at the second annual church conference. This is a 25 per cent increase over the enrollment last year.

The young people's one week short course held in June was attended by 22 girls and 38 boys. These were the champions in 19 counties in the various agricultural and home economics projects.

With well over 2,000 people in attendance, Experiment Station Day, June 22, was probably the most successful ever held. Upwards of 400 automobiles were parked on the grounds, which is said to be easily the largest number that have come for a similar event. The number of women in attendance was estimated at over 400, and the special features that were prepared for them were very favorably received. The exhibits at the stock pavilion were unusually well attended, as were also the various demonstrations. A new feature was introduced in the rock blasting by means of picric acid.

The records of the State soils laboratory show that during the past 12 months 301 farms have been examined. Chemical analyses have been made of over 1,800 samples of soil from these farms and detailed reports prepared for the farm owners. In each case a comprehensive study is made of the soil problems of each individual farm.

Wildfire, a relatively new bacterial infection of tobacco which first made its appearance in Wisconsin last year, has been found again this season in about fourteen seed beds. This disease has proved very disastrous in some of the Eastern States, but it appears that the efforts of the U. S. Department of Agriculture and the station to control it are meeting with success. Many farms on which outbreaks occurred last year have been entirely free from the disease this season.

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EXPERIMENT STATION RECORD.

Vol. 49. SEPTEMBER, 1923. No. 4.

The broad phraseology of the original Morrill Act of 1862 and most of its supplementary legislation has permitted considerable diversity of type in the institutions maintained by the several States under its provisions. At present, collegiate instruction in agriculture for white students is offered under this act in twenty-five States by colleges of agriculture of State universities, in twenty-two States by independent colleges of agriculture and mechanic arts, and in the single instance of Massachusetts by a college organized around agriculture alone. Much difference of opinion has always existed as to the relative advantages of these various types, and in not a few States controversies have developed both on this point and on such general questions as the precise field and function of the agricultural college and its relations to other institutions.

The discussion of these matters by representatives of the institutions themselves has been a frequent theme at the conventions of the Association of Land Grant Colleges and other educational bodies. From time to time inquiries have also been made in many States by the legislature or other forces outside the institutions, looking toward some solution of difficulties which have arisen. In numerous instances, notably Iowa, Washington, North Dakota, Arkansas, and Nevada, the inquiry has taken the form of comprehensive studies by educational specialists under the auspices of the U. S. Bureau of Education. In other cases, commissions of representatives of education, agriculture, and other interests from within the State have conducted the inquiry, as in the case of Massachusetts discussed in these columns about five years ago.

One of the latest of these surveys to be completed is that of California, for which a formal report has recently become available. This inquiry, like that of Massachusetts, was in the hands of a special legislative commission on agricultural education. Its purpose was set forth in the enabling act as the "investigation of the entire problem of agricultural instruction and investigation," including elementary and secondary schools as well as higher education. The commission was specifically directed, however, to investigate the plan of operation and organization of the leading agricultural colleges of the United States and to formulate recom-

mendations for a reorganization of the agricultural instruction given in the University of California. The immediate point at issue was whether the interests of the State would be best promoted by the continued development of the College of Agriculture as an integral part of the university, or by the substitution of a separate institution located at Davis or elsewhere.

The commission endeavored to familiarize itself with the present status of higher education in agriculture by a survey of the present organization and work in ten other American colleges. These included the universities of Minnesota, Wisconsin, and Illinois, Purdue and Cornell universities, the Iowa State College, and the agricultural colleges of Oregon, Montana, Ontario, and Massachusetts. A wide range of types was thus under scrutiny, and opportunity was afforded for some interesting generalizations for the agricultural colleges as a whole, although, it may be mentioned, the southernmost member of the group selected was Illinois.

The items investigated dealt with the composition of the governing board, the facilities and physical equipment, the composition and characteristics of the student body and graduates, faculty and administrative relationships, curriculum and standards, and relations with State departments of agriculture. On most of these matters considerable diversity was found.

The point given special prominence as regards the governing boards was the relatively small proportion of farmers thereon. Of the 162 trustees at the 11 institutions visited, only 13 were engaged in agriculture, and some of the institutions most strongly agricultural had none or but a single representative of the industry. This feature it was generally agreed was of minor importance. As one president expressed it, "the efficiency of a board of regents depends upon the character of the men, not on their occupations. We have had farmers on our board who have been entirely unsatisfactory to the college and men in other occupations who have earnestly promoted its best interests." None the less, the commission took the ground that in a State as highly agricultural as California the more frequent appointment as regents of men who are leaders in rural life would be desirable. The organization of advisory committees representing various phases of the agricultural industry, as has been done in Illinois and other States, was also recommended.

The amount of land needed by an agricultural college was a phase to receive particular consideration because of its importance as a factor in the California situation. Throughout its history the College of Agriculture has been handicapped by the small acreage available at Berkeley, where to-day only three acres of tillable land and 100 acres of pasture are at its disposal. To some extent this difficulty has been surmounted through the acquisition of the Univer-

sity Farm at Davis, 65 miles away, and the Graduate School of Tropical Agriculture and Citrus Experiment Station at Riverside, where 477 acres in the heart of the citrus region are at hand. Administrative and other difficulties have been encountered, however, and the question has been raised as to whether the agricultural college might not be advantageously separated from the university and reestablished elsewhere.

The commission found great variation in the physical equipment of the institutions visited and an even greater difference of opinion as to the amount of land really necessary for a successful college. One educator of long administrative experience is said to have expressed the view that with 100 acres for demonstration and instructional purposes the university could equal any institution in the country and surpass any separate agricultural college. The other extreme was represented by a college with 1,500 acres of tillable land, which considered that its own work could be much improved were twice its acreage available. Without attempting to solve the question as a whole, the commission recommended the immediate purchase of an available tract of from 100 to 200 acres of tillable land conveniently accessible to the campus. If this tract were to be used as an "outdoor laboratory" rather than as a farm, the belief was expressed that the more imperative needs of the college would be satisfied. A large acreage of hill land for the use of the forestry and animal husbandry departments which was also available was suggested as a desirable supplementary purchase or leasehold.

The commission recommended definitely that the College of Agriculture be maintained as an integral part of the university, under the president and board of regents, but with "the largest measure of autonomy in educational matters compatible with the existence of a unified university policy." For the present at least it suggested that instruction should be divided between Davis and Berkeley where such division is necessary to provide the physical facilities incident to a proper agricultural education. In general a course would correlate with a system of junior colleges in the State, making it possible for the student to spend his first two years at Davis, Berkeley, or elsewhere, and the final two years at Berkeley. This policy is in general harmony with the views expressed by the educators consulted.

It was recognized by the commission that this solution would necessitate material improvements in the Berkeley plant. In addition to the immediate acquisition of land already referred to, the construction of a large building to complete the agricultural group, further classrooms and laboratories for plant and animal nutrition, greenhouses for research in plant and animal life, a factory-type building to house investigations in such operations as the canning and

drying of fruits, the preservation of meats, and the utilization of wool and vegetable fiber products, and a laboratory for research and demonstration in agricultural engineering is regarded as essential.

Although the report dealt largely with academic instruction, much commendation was expressed of the work of the station and the extension service. The centralization of station work at Berkeley, Davis, and Riverside was advocated so far as possible. In the case of specific problems characteristic of particular localities, the opening of more or less temporary stations was suggested, the expenses for land and buildings to be met as far as possible by the community in which they are located. As some ten centers of station activity are now in operation, the adoption of this policy would evidently involve considerable readjustment of activities in several localities.

The relations of the colleges of agriculture and the State departments of agriculture in the various States were gone into in some detail. There was found to be a general agreement that these two bodies should be entirely separate, the college directing and conducting all work of instruction, research, and extension, and the department representing the police power of the State and exercising all functions of regulation. The working agreement now in operation in California is quoted below as exemplifying a basis under which harmonious relations have come to succeed quite generally the friction and controversy formerly too often prevailing. This agreement provides that "the State department of agriculture should exercise executive and regulatory powers. The College of Agriculture should devote its energies to research and education, both resident and nonresident. It is quite certain that it is not in the interest of the public welfare that it should be charged with police duties. It is the function of the executive branch of the State, whose head is the governor, to enforce the laws relating to agriculture through the director of agriculture and his subordinates, and those relating to forestry through the Commission of Forestry. The functions of the university, and hence of the College of Agriculture, are investigation and teaching. The college should not seek to control the action of any person. Its primary function is to determine the truth and state it accurately. The college should not have placed upon it any commercial, executive, or police duties, nor should it be the policy of the State to appropriate money to the State department of agriculture for education or investigation, nor should it be the policy of the State to appropriate money to the College of Agriculture for regulatory purposes."

Under the heading of student enrollment, the commission submits enrollment statistics for 24 States as compared with the number of farmers, showing a wide range from 50 farmers per four-year agri-

cultural student in Oregon to 2,048 in Kentucky. From these statistics the commission concludes that "there is very evidently no great horde of eager young people clamoring for an opportunity to work out their destinies on the soil. Everywhere enrollment is lower than one would expect it to be in consideration of the character of the States in which the colleges are located. The truth is that the Morrill Act came as a result of the ideas of one man, not in response to a great social need, and the supply of agricultural colleges has been greater than the educational demand ever since. Fortunately they have abundantly justified themselves in the influence they have exerted, but the disappointment of California at the comparatively small enrollment in its agricultural college is shared by every State which we visited, no matter what the type of institution in it."

This quotation seems to indicate a belief on the part of the commission as to the real function of an agricultural college which is somewhat surprising. Evidently it implies that the primary purpose of such an institution is to supply an opportunity for large numbers of young people "to work out their destinies on the soil," yet this view is difficult to harmonize with that stated elsewhere in the report that the College of Agriculture "can not be expected to train the great army of farmers any more than the engineering colleges are expected to train the mechanics of the country, but is the only source from which agricultural leadership can be looked for with confidence."

This latter concept, it is scarcely necessary to say, represents much more accurately the prevailing opinion among educators to-day. While it may be desirable for these colleges to have a somewhat larger enrollment in their four-year courses, it can hardly be expected that great numbers of young people from the farms will pursue them. The probability is rather that through the long undergraduate and graduate courses the colleges will train leaders of agricultural practice, including teachers, investigators, and a limited number of managers with relatively large farm enterprises. Through short courses, extension work, and publications, however, they reach and influence thousands of people, young and old, on the farms, and thus help in a large way to improve the social and economic conditions of rural life.

Nor does it seem likely that there will be general agreement with the view expressed that "the Morrill Act came as a result of the ideas of one man." Evidence in abundance exists to demonstrate that it was, in fact, the result of a movement which had been going on in the United States for many years, and had been advocated by Turner in Illinois and others. This was a movement to establish a broader type of colleges than the old classical institutions. What

the new institutions were to do was to emphasize science and its application to agriculture and the mechanic arts, while not neglecting other branches needed for a liberal education. It is true that agriculture was emphasized in the discussions in Congress, but the act itself provided for very broad institutions. Already one such institution had been somewhat definitely planned in New York State, and the man who was to be president of that institution was active in helping Senator Morrill to shape up the act. After its passage, Mr. Cornell undertook to establish an institution such as the act provided for, and the result was Cornell University, which provided in its charter that instruction might be given on any subjects which students desired to be taught.

From the foregoing discussion it should be evident that in its recommendation for a continuance of the College of Agriculture as an integral part of the University of California the commission was attempting merely to solve a local problem. The academic question of separate agricultural college versus State university and the very concrete one of the relations between State universities and land grant colleges when both are maintained were presumably regarded as beyond the scope of its inquiry, and its findings were doubtless obtained without expectation that they would be considered as a general educational contribution. Even from the narrower point of view, however, a useful service appears to have been rendered. The commission states in the closing paragraph of its report that it "is unanimous in the belief that one of the greatest causes of criticism of the College of Agriculture of the University of California has been a lack of knowledge amongst the farmers of the State as to its activities and the very notable results of its teaching and research." Even a somewhat cursory survey, if carried on fairly and intelligently by a group from within the State in whom there is general public confidence, can do much to clarify a perplexing situation and correct many misconceptions. Irrespective of whether the California commission's findings are eventually accepted as a basis for action, opportunity has been afforded for more enlightened consideration on the part of those having the matter in charge.

As regards the larger issue of how the agricultural colleges may best articulate with the educational systems of the States in general, perhaps the chief value of this report is to demonstrate what an important factor local circumstances may be. This is in accordance with the findings of the Bureau of Education, which has done much to bring about more harmonious contacts by its recognition in at least one State of the existence of special conditions due to geographical conformation and similar factors which justify what

might otherwise appear to be serious duplication of work by the land grant college and the State university. There is much reason to believe that the very diversity of type between the land grant colleges of the various States which is sometimes criticized has the great advantage of an adaptability to local conditions which might have been sacrificed under undue standardization. Even after sixty years, higher education in agriculture is still a recent development in this country, and while doubtless the trend will be toward substantial uniformity, "unity in diversity" may well, for some time to come, continue to be a justifiable characterization of the agricultural college system.

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RECENT WORK IN AGRICULTURAL SCIENCE.

AGRICULTURAL CHEMISTRY—AGROTECHNY.

Fourth report on colloid chemistry and its general and industrial applications, F. G. DONNAN ET AL. (*Brit. Asso. Adv. Sci., Rpt. Colloid Chem.* [*etc.*], *4 (1922), pp. 382, figs. 19*).—This volume follows the plan of the previous reports (E. S. R., 47, p. 9). The titles and authors are for part 1, Colloid Problems in Analytical Chemistry, by H. Bassett; Cataphoresis: The Motion of Colloidal Particles in an Electric Field, by E. F. Burton; Colloid Systems in Solid Crystalline Media, by C. H. Desch; Molecular Attraction and the Physical Properties of Liquids, by E. Edser; Membrane Equilibria, by W. E. Garner; Disperse Systems in Gases, by W. E. Gibbs; The Theory of Lubrication, by W. B. Hardy; and Application of Colloid Chemistry to Mineralogy and Petrology, by A. Scott. Part 2 contains The Colloid Chemistry of Soap, II, The Soap Boiling Processes, by J. W. McBain and E. Walls; The Concentration of Ores by Flotation, by E. Edser; Colloids in Catalytic Hydrogenation, by E. F. Armstrong and T. P. Hilditch; The Rôle of Colloids in Electrolytic Metal Deposition, by H. J. S. Sand; Rubber, by H. P. Stevens; and Colloidal Fuels, Their Preparation and Properties, by A. E. Dunstan.

The chemistry of the strength of wheat flour, H. E. WOODMAN (*Jour. Agr. Sci.* [*England*], *12 (1922), No. 3, pp. 231–243*).—The question of the identity or nonidentity of the gluten proteins of weak and strong flours has been reinvestigated by the racemization method, which depends upon the change in the optical rotatory power which solutions of protein in dilute alkali undergo when kept at 37° C. If two proteins are identical and are racemized under the same conditions, the solutions will show the same initial rotation, the same final rotation, and the same rate of diminution of rotation.

In the present investigation samples of gliadin and glutenin were isolated from typical strong and weak flours and subjected to this method of racemization. As judged by the results obtained, the gliadins of strong and weak proteins are identical, while the glutenins are two distinct substances. "It is suggested that the existing ideas on flour strength require modification to include the facts recorded in this investigation. It is desirable to retain the dual conception of strength as put forward by Wood [E. S. R., 20, p. 260]. The factor which determines the size of the loaf is most probably connected with the diastatic capacity of the flour, as was suggested by this investigator. On the other hand, the factor which determines the shape of the loaf, and which appears to be directly related to the physical properties of the gluten of the flour, is possibly dependent on the particular glutenin mechanism possessed by the wheat."

Protein and oil content of soy beans (*Ohio Sta. Bul. 362 (1922), p. XIII*).—Data are reported on the protein and ether extract content of 15 varieties or strains of soy beans, the analyses being based on a moisture content of 10 per cent. The range in protein content (N×6.25) was from 33.33 to 42.44 per cent and of oil from 12.86 to 19.26 per cent, a high content of the protein

being generally associated with a low content of oil. The variety known as Manchuria 20,173 had the highest oil and lowest protein content of any of the varieties tested.

Studies with corn pollen.—I, Analysis and composition of corn pollen. II, Concerning certain lipoids, a hydrocarbon, and phytosterol occurring in the pollen of white flint corn, R. J. Anderson and W. L. Kulp (*New York State Sta. Tech. Bul. 92 (1923), pp. 3–37*).—These papers have been previously noted from other sources (E. S. R., 47, p. 12; 49, p. 201).

Technique for determining bacterial count, O. M. Henriques (*Compt. Rend. Soc. Biol. [Paris], 88 (1923), No. 11, pp. 819, 820*).—The use of a colloid protector such as 0.5 to 2 per cent of gum arabic or 2 per cent of peptone is recommended in preparing a suspension of bacteria for determining the bacterial count.

On the colorimetric determination of H-ion concentration in soils, C. T. Gimingham (*Jour. Agr. Sci. [England], 13 (1923), No. 1, pp. 69–73*).—The preliminary results are reported of an investigation of the applicability of the displacement or percolation method of obtaining soil extracts as described by Parker (E. S. R., 46, p. 420) to the preparation of clear soil extracts for use in colorimetric determinations of the H-ion concentration. By taking the precaution to determine the pH value as soon as sufficient liquid was obtained and to protect the sample from the air, consistent pH values for samples of the same soil taken at different times were obtained, and the results showed satisfactory agreement with those obtained by electrometric titration on the same soils. In later work, however, it was found that the colorimetric values of successive portions of the percolate became higher, and that the higher values obtained with the more turbid liquid corresponded more closely with the values obtained by electrometric titration. No satisfactory explanation of this difference has yet been obtained.

On the estimation of nitrates in soils by the phenoldisulphonic acid method, C. T. Gimingham and R. H. Carter (*Jour. Agr. Sci. [England], 13 (1923), No. 1, pp. 60–62*).—Attention is called to a possible source of error in the Emerson modification of the phenoldisulphonic acid method of determining nitrates in soils (E. S. R., 46, p. 806). This consists in the possible absorption of nitrates by the filter paper if the latter is not sufficiently coarse.

Estimation of nitric nitrogen and total nitrogen in plant tissue extracts, P. H. Gallagher (*Jour. Agr. Sci. [England], 13 (1923), No. 1, pp. 63–68, fig. 1*).—A critical examination of various methods of nitrate reduction suitable for use in determining nitrogen in plant tissue extracts has led to the adoption of a method based upon the use of Devarda's alloy (E. S. R., 4, p. 612), but with magnesia in place of sodium hydroxid.

In the method as applied to plant extracts an equal volume of rectified alcohol is added to the solution to precipitate the colloidal matter. After this has been filtered off an aliquot of the filtrate, equivalent in nitrate nitrogen to about 0.1 gm. of potassium nitrate, is distilled with steam for 45 minutes in the presence of 1 gm. of Devarda's alloy and 0.5 gm. of freshly ignited magnesia. A blank determination is run in which the same volume of filtrate is distilled for the same length of time with 0.5 gm. of magnesia alone.

In Kjeldahl nitrogen determinations in the presence of nitrates, if the separate determination of nitrates is not required, 2 cc. of 25 per cent NaOH can be substituted for the magnesia and the mixture distilled directly for 30 minutes.

Determination of starch content in the presence of interfering polysaccharids, G. P. Walton and M. R. Coe (*Jour. Agr. Research [U. S.], 23 (1923), No. 12, pp. 995–1006*).—A study is reported from the Bureau of Chemistry,

U. S. D. A., of various methods of determining the starch content of materials such as impure linseed meals, apple products, etc., which contain mucilage, pectins, and other interfering substances. The method finally adopted is summarized as follows:

"Extraction of the material with ether, alcohol of from 25 to 35 per cent strength, depending on the material, alcohol of full strength, and finally again with ether to eliminate interfering soluble substances; gelatinization and conversion of the starch by digestion with an infusion of barley malt; elimination of interfering polysaccharids by precipitating these substances in 60 per cent alcohol; evaporation of the filtrate to drive off the alcohol, and subsequent acid hydrolysis of the starch conversion products; defecation of the resulting dextrose solution with phosphotungstic acid; and determination of the dextrose by copper reduction."

To test the accuracy of this method, definite quantities of a standard sample of starch were added to linseed meal of known purity, and the resulting mixture was analyzed for starch by the proposed method. A recovery of from 97.2 to 99.9 per cent of the added starch was obtained. The possibility of adsorption of the starch conversion products by colloids coagulated by the 60 per cent alcohol was studied by precipitating twice with the 60 per cent alcohol and analyzing both filtrates. The amount of adsorption was found to be negligible.

Determination of reducing sugars by means of Fehling's solution with methylene blue as internal indicator, J. H. Lane and L. Eynon (*Jour. Soc. Chem. Indus., 42 (1923), No. 4, pp. 32 T–37 T; abridged in Internatl. Sugar Jour., 25 (1923), No. 291, pp. 143–149*).—The use of methylene blue as an internal indicator in the determination of reducing sugars by Fehling's solution is recommended as having many important advantages over other methods. "It is at least the equal of gravimetric methods in point of accuracy, and incomparably more expeditious and convenient in manipulation. It is not affected by the presence of suspended matters in the liquid to be titrated, nor by the presence of substances which retain cuprous oxid in solution."

In the technique employed by the authors, the approximate volume of the sugar solution required is determined by a preliminary "incremental" titration in which 10 or 25 cc. of the Fehling's solution and 15 cc. of the sugar solution are boiled for about 15 seconds over a wire gauze. If the copper is almost entirely reduced, as is evident by the red color of the liquid, a few drops of the methylene blue indicator are added and the boiling is continued with the addition, every 10 seconds, of 1 cc. of the sugar solution until the color is completely discharged. If after the preliminary boiling there appears to be considerable unreduced copper, a further 10 cc. of sugar is added and the boiling continued for another 15 seconds, the process being repeated until it is apparent that nearly enough sugar has been added, when the titration is completed as before.

For the titration proper 10 or 25 cc. of the Fehling's solution is measured into a 300- or 400-cc. flask and treated while cold with almost the whole of the sugar solution required, as determined by the preliminary titration. The flask is then heated on a wire gauze until the liquid has been boiling moderately for 2 minutes. From 3 to 5 drops of the methylene blue indicator is then added without removing the flask from the flame, and the sugar solution is added 2 or 3 drops at a time at intervals of about 10 seconds until the color of the methylene blue is completely discharged. The entire process should be completed in 3 minutes from the time the reaction liquid begins to boil.

Tables are given of the factors for invert sugar (alone or in the presence of sucrose), dextrose, levulose, maltose, and lactose corresponding to the num-

ber of cubic centimeters of the sugar solution required for the titration with 10 or 25 cc. of Fehling's solution.

Sodium chlorid from milk, C. PORCHER (*Lait, 3 (1923), No. 1, pp. 11–21*).—Data from various sources on the composition of milk are presented to illustrate the author's theory that the sodium chlorid in the milk serves to regulate the osmotic equilibrium and varies in amount according to the amount of the other constituents present, particularly lactose. A high content of lactose is thought to be always accompanied by a low content of sodium chlorid and vice versa.

The methylene blue method of estimating the keeping quality of milk (*New Hampshire Sta. Bul. 208 (1923), pp. 19, 20*).—Preliminary work indicates that the methylene blue test gives a satisfactory index, and that there is a fairly definite relation between the reduction time of the methylene blue test and the number of bacteria as shown by the plate method. For example, a reduction time of 3 hours or less corresponds to a bacterial count of 500,000 or more per cubic centimeter, a reduction time of from 4 to 7 hours approximately 150,000 bacteria per cubic centimeter, and a reduction time of 8 hours or more under 25,000 bacteria per cubic centimeter.

The acetic index in the analysis of butter, E. SAVINI (*Ann. Ist. Sper. Caseif. Lodi, 1 (1922), No. 5–6, pp. 199–218*).—This is a general discussion of the value of the acetic index, as suggested by Fascetti (E. S. R., 48, p. 13), for detecting the adulteration of butter, particularly with cacao butter and margarin.

The data reported on the analyses of various samples of pure and adulterated butter conform to the results reported by Fascetti. The acetic index of fresh butter ranged from 64 to 66, of butter adulterated with 5 per cent of cacao butter from 60 to 61, and of butter adulterated with 5 per cent of margarin about 70. With increasing amount of cacao butter the index varied as follows: With 10 per cent cacao butter 59, 20 per cent 57, 40 per cent 49, and 50 per cent from 45 to 46.

The determination of various monohydric phenols by the phenol reagent of Folin and Denis, C. HENNINGSEN (*Indus. and Engin. Chem., 15 (1923), No. 4, pp. 406, 407*).—The phosphotungstic-phosphomolybdic acid reagent of Folin and Denis has been applied to the determination of monohydric phenols in dilute aqueous solution. In the experimental work reported, β-naphthol is used in place of phenol as the standard, as offering the advantage of being a solid which can be weighed directly with accuracy. It is emphasized that for accurate determinations the details must be carried out in as uniform a manner as possible.

Losses in the refining of edible oils, B. H. THURMAN (*Indus. and Engin. Chem., 15 (1923), No. 4, pp. 395–397*).—This paper deals with the losses occurring during the various stages in the refining operations for cottonseed, corn, peanut, soy bean, and coconut oil. Considered in order, these losses are due to moisture, gasoline-insoluble material, phosphatids (in the case of cottonseed oil only), other nonfatty acid material, glycerol by saponification, loss by emulsion, solubility loss, glycerol loss by hydrolysis, volatility loss, and bleaching loss.

Soy and related fermentations, M. B. CHURCH (*U. S. Dept. Agr. Bul. 1152 (1923), pp. 27, pls. 2, figs. 5*).—The investigation reported in this publication was undertaken to determine whether the oriental soy bean sauce can be manufactured successfully in this country. A detailed description, with photographic illustrations, is given of the process of manufacturing the sauce as conducted in Japan. This is followed by the report of attempts to duplicate the process in an apparatus especially constructed for the purpose, and also to prepare a similar sauce from peanut press cake. A discussion of the chemical processes

involved and of the practicability of developing the process on a commercial scale and a description of related fermentations—miso, natto, and curd or to-fu are included.

The soy sauce is made by a fermentation process in which soy beans, previously soaked and boiled to a mash, and wheat, roasted until slightly brown and then crushed unevenly, are first treated with a mold ferment from the *Aspergillus flavusoryzae* group until thoroughly ripened. The material then undergoes a brining process in which the activity of the mold fermentation continues under controlled conditions for from six months to a year.

In the experimental work reported, a study of the product obtained with varying proportions of prepared beans and wheat showed that for the best results the mixture should contain at least 1 part of prepared wheat to 3 parts of prepared beans by weight. It was found that undesirable fermentation from contamination of the material with bacteria can be avoided by soaking the beans for 24 hours in cold running water and then cooking them for 30 minutes at 15 lbs. pressure, and by roasting the wheat and then exposing it in a room for cooling. If the beans are soaked in unchanged water at a temperature of from 20 to 22° C. and the wheat does not receive a preliminary roasting, bacterial action resulting in the formation of ammonia and evidences of putrefaction result. It is noted, however, that certain bacteria and yeasts are always present in the finished product and probably have some influence on the ripening of the sauce.

It was found possible to prepare a sauce with an acceptable flavor from peanut press cake in a manner similar to the preparation of the soy sauce. Greater care had to be taken however, in the control of the bacterial activity.

In discussing the practicability of manufacturing soy sauce in this country, it is pointed out that a properly flavored and uniform output can be produced only at a comparatively great expense and after a certain amount of experimentation has been conducted. It is thought that at present such production should be undertaken only in conjunction with some already established and related industry.

The utilization of whey (*Jour. Roy. Agr. Soc. England, 83 (1922), pp. 73–96, figs. 2*).—This report of investigations carried on under the direction of the research committee of the Royal Agricultural Society of England on the problem of the utilization of whey consists of three parts as follows:

I. *Introduction*, C. D. Whetham (pp. 73–77).—This is a brief discussion of the scope and general results of the investigation.

II. *A soluble lactalbumin from whey*, C. P. Stewart (pp. 77, 78).—In various attempts to obtain a soluble lactalbumin from whey, the best results were obtained by heating the whey to 95° C., filtering off the coagulum, dissolving it in an excess of N/5 NaOH, reprecipitating with HCl, washing the precipitate, and then grinding it to a paste with sufficient N/10 NaOH to give a product containing 2 per cent NaOH. This product is said to be easily soluble in water and not to contain sufficient alkali to be harmful.

III. *The extraction of lactose and lactalbumin from fresh and from condensed whey*, L. Harding (pp. 78–96).—A brief review of the literature on the methods in use for the manufacture of lactose is followed by a description of the method adopted by the author for its preparation on a laboratory and commercial scale. The laboratory method is essentially as follows:

A 25-cc. portion of the whey is first neutralized with N/10 NaOH, using phenolphthalein as indicator. The bulk of the whey is then neutralized at a temperature of from 70 to 85° with the chemical equivalent in precipitated chalk of the amount of alkali used minus 3. After standing for 7 minutes

the mixture is filtered, and the filtrate is further clarified by reheating to from 65 to 70°, and adding for each 100 gal. of whey 6 lbs. of precipitated chalk, followed by 8 lbs. of aluminum sulphate (14 per cent Al_2O_3). If it is not considered desirable to recover the albumin, the coagulating and clarifying processes may be combined. To obtain the lactose the clear filtrate is evaporated at 60° in a vacuum pan to a density of 1.2. On standing for 24 hours the lactose separates as white crystals of 96 per cent purity, which can be purified still further by recrystallization after treatment with acetic acid and charcoal.

Attempts to obtain a dried whey which would serve for the extraction of lactose and albumin showed that when dried on rollers in the ordinary way, as in the preparation of a cattle food, the product can not be used with any success. However, when dried in vacuo at a temperature of 60° in the presence of a small amount of precipitated chalk a product of excellent quality can be obtained.

The application to technical scale operation of the above outlined method of obtaining lactose from whey is described in detail, with a diagram of the required machinery, and data on the yield and estimated cost of producing pure lactose are presented. Allowing for factory losses, a yield of lactose amounting to 2.5 per cent of the weight of the whey is given as a conservative estimate with a probable cost of 8d. a pound.

In searching for a means of concentrating the whey so that it can be shipped from small producing plants to large central factories, it was found that good yields of lactose and a promising source of albumin can be obtained from a concentrated but not dried whey. The method of separation consists in first warming the whey to 45° and separating the fat in a Sharples separator. The liquid is then neutralized with chalk, as described above, and the filtrate immediately evaporated in a vacuum pan to a density of 1.26. On cooling the concentrated liquid the suger crystallizes out, and a part of the albumin is separated at the same time. These are partially separated by certrifuging in a hydro-extractor fitted with wire gauze. The crude sugar thus obtained is further purified by washing in the hydro-extractor or by elutriation. The mother liquor from the first separation is concentrated again in the vacuum pan, with or without the addition of chalk, depending upon the acidity. The second crop of sugar and albumin can be separated as the first crop, or still better by means of a Gee centrifugal separator which will give the albumin at the top and the sugar at the bottom of the drum. It is possible to obtain a small third crop of sugar and also to recover uncoagulable albumin in the third molasses. A yield of 4.36 per cent of crude lactose, or 3.2 per cent of pure lactose, has been obtained in this way. The estimated cost of producing concentrated whey on a small scale is 2½ d. a pound. With larger amounts the cost would be still less.

METEOROLOGY.

Precipitation and humidity, J. B. Kincer (*U. S. Dept. Agr., Atlas Amer. Agr., pt. 2, Sect. A (1922), pp. 48, figs. 108*).—This section of the Atlas of American Agriculture, a review of which has been previously noted (E. S. R., 47, p. 414), gives a selected list of references on the subject and numerous maps and diagrams showing the distribution and variation of precipitation and humidity in the United States, based for the most part on the uniform 20-year period, 1895–1914. Conditions modifying precipitation and determining its type, as well as the rainfall requirements of crops in different parts of the country, are discussed.

Paradoxical rainfall data, A. McAdie (*Nature [London], 111 (1923), No. 2785, p. 362*).—A study of rainfall measurements at Blue Hill Observatory, Massachusetts, shows that "the driest month is June and the wettest is March. Yet the driest month in the whole period was March, 1915, when the total rainfall was only 1 mm. What is equally remarkable, the wettest month was June, 1922, when 274 mm. fell. It is difficult to explain these rainfalls on any theory of probability. The June rainfall was not due to abnormally heavy showers."

Paradoxical rainfall data, R. A. Fisher (*Nature [London], 111 (1923), No. 2788, p. 465*).—Rainfall data at Rothamsted during the 70 years ended February, 1923, are analyzed, showing that "the variability of rainfall in the same calendar month is so great that the mean values give little or no indication as to which month should be expected to score a record for rain or drought." Reference is made to observations at Blue Hill Observatory during 37 years, noted above, which led to a similar conclusion.

Thermal belts and fruit growing in North Carolina, H. J. Cox (*U. S. Mo. Weather Rev. Sup. 19 (1923), pp. 1–98, pls. 6, figs. 53*).—Observations on temperature at 68 stations at 16 places in the mountain region of North Carolina are summarized and discussed with reference to correlation of the temperature conditions with topography and fruit growing.

The data presented indicate that the topography of the region in relation to the minimum temperature is the controlling factor in fruit growing. The necessity for great care in the selection of orchard sites is clearly brought out. It is shown that valley floors, coves, shade, and frost pockets of all kinds must be avoided.

It was observed that on valley floors "the temperature on critical nights of inversion often falls 15 or 20°, and sometimes even 25 or 30°, lower than higher up on the slope."

It is shown that "the mountain breeze does not develop at night and flow down a valley unless there is great surface area around the summit station. On no valley floor where the slopes culminate in knobs has the nocturnal breeze been noted. . . . Before such a breeze develops, there must be available a relatively large amount of heavier and potentially colder air above. And this can only occur over a plateaulike surface. There is no opportunity for such development over a knob. Where the highest points are mere peaks or knobs, they partake of the temperature of the free air surrounding and are always relatively warm on nights of inversion, and this, too, in spite of the fact that a knob is best situated topographically for loss of heat through radiation, as its angle of free radiation may exceed even 180°. . . .

"On a short slope culminating in a knob no more than 500 ft. in elevation, the height being insufficient to cause more than a degree or two difference in temperature between valley floor and summit on nights of norm conditions . . ., the summit is the safest section for fruit growing, because during nights of inversion the highest minima are practically always registered at that level. This usually is the case on slopes even up to levels as high as 1,000 ft. above the valley floor. . . .

"An ideal slope for fruit growing is one of moderate elevation above sea level, the basic altitude varying, of course, in different portions of the country, fairly steep, and culminating in a knob with no surrounding mountains, or, if any, at least situated so far distant as to have no effect upon the temperature conditions of the slopes involved."

Cold waves in Brazil, S. Ferraz (*Rev. Mens. Met., 1 (1922), No. 3–5, pp. 37–44, pls. 2; abs. in Internatl. Rev. Sci. and Pract. Agr. [Rome], n. ser., 1 (1923),*

No. 1, pp. 80, 81).—This article indicates how, with the aid of consecutive synoptic pressure charts for South America, a cold wave may be forecasted two to three days in advance and precautions taken to prevent or diminish injury from it.

Frost protection in Sao Paulo (Brazil), E. L. Berlinck (*Rev. Mens. Met., 1 (1922), No. 3–5, pp. 33–36; abs. in Internatl. Rev. Sci. and Pract. Agr. [Rome], n. ser., 1 (1923), No. 1, pp. 81, 82*).—The successful use, by a coffee planter, of smudges from burning leaves of maize soaked with tar as protection against frost is cited and the use of control measures when the forecasts indicate their needs is urged.

SOILS—FERTILIZERS.

[Soil studies at the Illinois Station] *Illinois Sta. Rpt. 1922, pp. 13, 14*).—It is stated that analyses of soils from the State made in connection with soil survey work, have indicated a rather close correlation between the sulphur and organic matter contents. This is taken to indicate that a considerable portion of the soil sulphur exists in organic combinations. It is further stated that not only is there a large degree of variation in the sulphur content of different soils, but in some parts of southern Illinois, soils quite deficient in sulphur occur in the same general locations as where insignificant amounts of this element are precipitated in the rainfall.

Analyses of samples of rain water taken monthly from 12 different localities of the State are said to have shown that the sulphur brought down in rain had a maximum variability in the different localities in the month of August, when it ranged from 0.29 to 11.13 lbs. per acre for the month. These amounts were also the extremes for the season. The amounts of sulphur in the rainfall for the season were greatly increased by proximity to sources of supply, such as large cities, railway centers, and sulphid ore reducing plants. Most of the areas included in the study received enough sulphur from the atmosphere in rain to suffice for the crops grown.

Studies with sweet clover as a green manure crop for corn are said to have shown that sweet clover when plowed under as a green manure furnishes large amounts of nitrate nitrogen. The large nitrogen content of sweet clover from brown silt loam and gray silt loam soils is taken to indicate that a large fixation of nitrogen occurs in these soils.

Soil survey of Mills County, Iowa, G. B. Jones and N. J. Russell (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1920, pp. III+103–134, fig. 1, map 1*).—This survey, made in cooperation with the Iowa Experiment Station, deals with the soils of an area of 275,200 acres in southwestern Iowa. The topography of the upland varies from undulating to rolling and hilly. The extensive first bottoms and terraces are prevailingly level. The county is said to be well drained in a southwesterly direction.

The soils are grouped as upland and alluvial types, both of loessial origin. Including riverwash and meadow, 17 soil types of 9 series are mapped, of which the Marshall and Wabash silt loams cover 58.4 and 21.8 per cent of the area, respectively.

Soil survey of Guilford County, N. C., R. C. Jurney et al. (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1920, pp. III+167–199, fig. 1, map 1*).—This survey, made in cooperation with the North Carolina Department of Agriculture, deals with the soils of an area of 416,000 acres lying entirely within the Piedmont Plateau region in north-central North Carolina. The topography varies from almost level to gently rolling, rolling, and broken. The county is said to be thoroughly drained.

The soils are said to be of residual and alluvial origin. Including meadow, 18 soil types of 9 series are mapped, of which the Wilkes sandy loam, Cecil clay loam, and Appling sandy loam cover 25.2, 19.3, and 16.6 per cent of the area, respectively.

Soil survey of Multnomah County, Oreg., C. V. RUZEK and E. J. CARPENTER (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1919, pp. III+47–98, pls. 2, fig. 1, map 1*).—This survey, made in cooperation with the Oregon Experiment Station, deals with the soils of an area of 209,920 acres in northwestern Oregon. The topography of the county is said to be varied, ranging from the comparatively level alluvial lands along the Columbia River and tributary streams to the hilly and mountainous districts along the eastern and western boundaries. With the exception of the lands along the Columbia River, the drainage of the county is said to be excellent.

The soils are of residual and transported origin. Including rough mountainous land, rough broken and stony land, and riverwash, 23 soil types of 13 series are mapped, of which the Powell silt loam, rough mountainous land, Salem gravelly fine sandy loam, Olympic silt loam, and Sauvie silty clay loam cover 16.2, 11.2, 10.8, 10.6, and 10.6 per cent of the area, respectively.

A new method for the mechanical analysis of soils and other dispersions, G. W. ROBINSON (*Jour. Agr. Sci. [England], 12 (1922), No. 3, pp. 306–321, figs. 4*).—Studies on methods of mechanical analysis of soils conducted at the University College of North Wales are briefly described, and the expression of mechanical composition by means of continuous curves is discussed. It is suggested that a convenient representation will be obtained by showing summation percentage as a function of the logarithm of settling velocity.

Studies of the effect of a gel coating on the settling velocity of a particle showed that a reduction in velocity took place which is a simple function of the thickness of the gel coating. A method is outlined by which the mechanical composition of a soil or clay is derived from determinations of the concentration of a settling suspension for different values of the ratio of depth to time. A shortened method is also described, which gave results agreeing closely with those obtained by the present standard methods.

A further study of the nature of the concentration gradients in a settling column of a suspension showed that below the first few centimeters the change in concentration with depth is very gradual.

Note on the mechanical analysis of humus soils, G. W. ROBINSON (*Jour. Agr. Sci. [England], 12 (1922), No. 3, pp. 287–291*).—In a contribution from the University College of North Wales, attention is drawn to the inaccuracies introduced in mechanical analyses of soils where large quantities of organic matter are present. Studies made in an attempt to destroy the organic matter without attacking the clay or fine mineral particles showed that treatment with hydrogen peroxid offers a convenient means of removing organic matter from soil without altering the mineral portion, although it was impossible to remove all of the organic matter. It was also found that the soluble products of oxidation appeared to be deflocculating in their action and increased the degree of dispersion of the soil.

The interpretation of mechanical analysis of soils as affected by soil colloids, R. O. E. DAVIS (*Jour. Amer. Soc. Agron., 14 (1922), No. 8, pp. 293–298*).—In a contribution from the U. S. D. A. Bureau of Soils, mechanical analysis of soil is discussed with particular reference to the difficulty interposed by the colloidal content of soils. The difficulty of securing an accurate mechanical analysis due to inadequate deflocculation is also briefly described. Experiments have shown that the most active portion of the soil is very absorptive, and that this absorptive part consists largely of the soil colloid.

Further studies have indicated that this colloidal soil material is probably the double silicate of iron and alumina.

Determination of the swelling coefficient of dry soils when wetted, A. E. Vinson and C. N. Catlin (*Jour. Amer. Soc. Agron., 14 (1922), No. 8, pp. 302–307, pl. 1*).—In a contribution from the Arizona Experiment Station, a method for determining the swelling of dry soils when wetted is briefly described. Disks of the dry soil are obtained after having been compressed at from 30,000 to 35,000 lbs. These dry disks immediately after calipering are dropped into a brass swelling cup and placed in a convenient vessel on the MacDougal auxograph. Sufficient water is added quickly and the disk allowed to swell without further disturbance. Maximum swelling has been found to take place usually within from 30 to 40 minutes, although some soils continue to swell much longer. The maximum magnified swelling is read off from the sheet of millimeter paper carried on the clock drum of the auxograph, then calculated to absolute swelling by the use of a suitable factor, depending upon the length of the arm of the auxograph in use. The absolute swelling in millimeters of the disk in the vertical direction divided by its thickness gives the swelling coefficient.

Tabular data are given indicating the accuracy of the method and showing the correlation between the swelling coefficient and the mechanical analysis and moisture equivalent. It was further found that different soils show marked differences in the rate of swelling, and that chemical treatment modifies this rate enormously.

Some investigations on the electrical method of soil moisture determination, T. Deighton (*Jour. Agr. Sci. [England], 12 (1922), No. 3, pp. 207–230, figs. 6*).—Studies conducted at the Cambridge School of Agriculture are reported, the purpose of which was to find a method of moisture determination in the soil which does not require the taking of samples. Processes in use were reviewed, and an examination was made of the limits of accuracy of the electrical method for determining soil moisture. The electrical resistance over a small plat was found to vary under similar conditions, and it is concluded that these differences are probably due to actual differences in moisture or other factors.

An investigation of the effect of the distance apart of the electrodes indicated the probability of a minimum resistance between two electrodes under certain conditions. A mathematical investigation of the path of the electrical current in the soil gave results corresponding with the observed facts.

It is concluded that the electrical method gives the mean water content of a volume of soil somewhat greater than a sphere the poles of which are the electrodes. Certain resistance-moisture curves obtained in the laboratory are discussed. The opinion is expressed that, while the relation found by American investigators holds good at water contents above 10 per cent, namely, that the resistance varies inversely as the square of the moisture content, at lower water contents one and possibly two discontinuities appear in the curve. These discontinuities were reversed in the case of artificial mixtures not containing colloids. A tentative explanation of these phenomena is given.

Effectiveness of mulches in preserving soil moisture, F. S. Harris and H. H. Yao (*Jour. Agr. Research [U. S.], 23 (1923), No. 9, pp. 727–742, figs. 6*).—In a contribution from the Utah Experiment Station the average results of thousands of measurements of the influence of mulches on soil moisture are presented.

These showed that an effective mulch of 1 in. of straw is capable of preserving 60 per cent more moisture in the soil than is retained without mulching. Straw was the most efficient mulch material used in the experiments, followed in order by hay, grass, wood shavings, and manure. The loss of moisture from the soil was correlated with the percentage of moisture retained by the mulch. It was found that an efficient mulch must be constituted of material which does not absorb or retain moisture readily and which forms practically no capillary system in itself. An absorptive mulch could be used to advantage provided it was turned under before the beginning of the dry period.

The effectiveness of mulching and cultivation increased with their depths. The rate of evaporation from soils under mulch varied according to their moisture contents. The finer soils lost the most water. Clay that had been ground into a fine powder in the laboratory lost less water than loam. While cultivation and mulching saved moisture, the evapo-transpiration ratio was least with no mulch or cultivation. Fall plowing preserved more moisture than spring plowing.

Soil moisture was more variable under field than under laboratory conditions. The 6-in. cultivation was not so efficient as the 4-in. This is taken to indicate that in the dry farm regions shallower cultivation is preferable to the deeper cultivations.

A bibliography is appended.

The color of soils in relation to organic matter content, P. E. Brown and A. M. O'Neal, jr. (*Iowa Sta. Research Bul. 75 (1923), pp. 275–300, figs. 14*).—Studies of the color of soil types and soil series mapped by different men in various counties in Iowa and a correlation of their color descriptions with their chemical contents of carbon and nitrogen are reported in this bulletin.

Data from 14 different soil types are taken to indicate that the average organic matter content of light colored soils is less than that of the dark colored types, but that variations in organic carbon and nitrogen contents in different samples of the same type may or may not be reflected in the color descriptions as given at present. There seemed to be little general relation between the color and the contents of carbon and nitrogen.

A general consideration of all the data indicates that the color descriptions are not as precise as the determinations of carbon and nitrogen. Thus there may be rather wide differences in the amounts of these constituents present which would not show at all in color descriptions. Dark colored soils were found to be more readily described than the light colored types, and the importance of the adoption of color charts and a definite color terminology is emphasized to eliminate as far as possible the personal equation in soil descriptions.

The formation of sodium carbonate in soils, A. B. Cummins and W. P. Kelley (*California Sta. Tech. Paper 3 (1923), pp. 35, figs. 2*).—Studies to determine why certain soils at the end of irrigation runs become relatively impermeable, hard when dry and puddled when wet, are reported.

These showed that when semiarid soils are brought to equilibrium with a sodium salt the combined calcium, magnesium, and potassium passing into solution are chemically equivalent to the sodium fixed, and the total of these ions is an exponential function of the concentration of the sodium salt remaining in solution. It was also found that the sodium fixed is an exponential function of the concentration of the sodium salt remaining in solution at equilibrium. The reactions involved are considered to be primarily chemical in nature.

Upon treatment with a sodium salt the soil underwent a change reciprocal to that occurring in the solution. While the solution was enriched with calcium, the soil was impoverished in that element. The solid particles, therefore, became relatively richer in sodium. The new sodium-silicate complexes formed by the action of sodium salts were less stable, more soluble, and more easily hydrolyzed than the corresponding calcium complexes. The properties of these sodium compounds were so pronounced as to modify profoundly the physical properties of the entire soil mass.

The effects of saturating a soil with sodium were most pronounced upon subsequent leaching with relatively pure water. The soil swelled, became impervious, and yielded a dark colored and frequently strongly alkaline percolate. These reactions are considered to be important in the formation of sodium carbonate in nature.

The formation of alkalinity was found to depend upon the tendency of the sodium silicate compounds to hydrolyze in the absence of too strong concentrations of electrolytes, with the resultant formation of sodium hydroxid. The sodium hydroxid was readily converted into sodium carbonate by the carbon dioxid of the soil solution. Some of the products of the hydrolysis showed a tendency to assume the colloidal state. This is considered to account for the deflocculated condition of the soil. It was shown that calcium carbonate is not essential for the formation of sodium carbonate by this reaction. Certain soils from humid regions, one of which was distinctly acid, reacted similarly but not so markedly as semiarid soils. Alkalinity was also developed by percolating water through columns of granites and several pure mineral silicates which had previously been treated with sodium chlorid.

With the soil studied, a N/100 solution of sodium chlorid was found to be of sufficient concentration to form hydrolyzable compounds, N/10 and N solutions were still more potent in this respect, while N/1,000 solutions had no apparent effect. It was further found that the concentration of the saturating solution of sodium chlorid must be reduced about one-half before alkalinity develops, but that lowering the concentration still further greatly increases the alkalinity. The greatest amount of alkalinity was obtained when the sodium-saturated soil was leached with pure water.

Soluble calcium salts when present in sufficient concentration prevented the formation of hydrolyzable sodium compounds in the soil. With a mixed solution of normal sodium chlorid, the addition of calcium chlorid equivalent to N/1,000 had no effect; N/100 calcium chlorid reduced the amount, while N/10 calcium chlorid completely prevented the reaction. Calcium ions tended to prevent the hydrolysis of sodium absorption compounds once they had been formed. N/10 calcium chlorid solutions completely prevented hydrolysis, while N/100 and N/1,000 calcium chlorid solutions were little more effective than pure water.

An example is given of the conversion of a natural saline soil into an alkaline soil, and of the development of alkalinity in a soil by mild treatment with sodium chlorid and subsequent leaching with pure water.

The removal of sodium carbonate from soils, W. P. Kelley and E. E. Thomas (*California Sta. Tech. Paper 1 (1923), pp. 24*).—Studies on the removal of sodium carbonate from soils by various means, including flooding, treatment with gypsum, elemental sulphur, and sulphuric acid, are reported. The soils included four fine sandy loams and a clay loam.

The results showed that elemental sulphur underwent reasonably active oxidation in alkali soils containing relatively high concentrations of various sodium salts. The products of the oxidation of sulphur finally neutralized the last trace of soluble carbonate in every soil studied except one. When solu-

tions of sulphuric acid were used, normal carbonate was first converted into bicarbonate. On the other hand, the products of the oxidation of sulphur decomposed normal carbonate and bicarbonate simultaneously. The addition of calcium sulphate produced a substantial decrease in soluble carbonates, but it failed to reduce the alkalinity completely, except when used in conjunction with leaching.

When considered on the basis of chemical equivalents sulphuric acid solutions were somewhat more effective than the products of the oxidation of sulphur, and considerably more so than calcium sulphate. The results indicated that each of these materials reacts in black alkali soils with substances other than carbonates. The products of the oxidation of sulphur and calcium sulphate also decomposed bicarbonates, and each appeared to react with alkaline silicates as well. These results are taken to indicate that the amounts of these materials which must be added to soils are apparently greater than is indicated by a determination of the water-soluble alkalinity, and that the excess apparently varies in different soils.

It was also found that the successful treatment of black alkali soil involved the necessity of considering also the subsoil, since injurious alkalinity commonly occurs in the subsoil as well as in the surface soil.

Both ferrous sulphate and alum neutralized the carbonates in each soil. The results indicated that either of these materials might be useful in the treatment of black alkali soil. Culture experiments extending over a period of two weeks indicated that soil after treatment with ferrous sulphate and leaching may be a favorable medium for growth. Attention is drawn in this connection, however, to the toxicity to plants of an excess of soluble ferrous iron or aluminum and the undesirable physical properties produced in black alkali soils by the gelatinous precipitates from these soils.

Relations between the active acidity and lime requirement of soils, E. T. Wherry (*Jour. Wash. Acad. Sci., 13 (1923), No. 6, pp. 97–102*).—In a contribution from the U. S. D. A. Bureau of Chemistry, a brief study of the subject is presented, in which lime requirement is stated in parts per thousand of calcium oxid and active soil acidity in the form of specific acidity. It is stated that the ratio between these factors in a given soil may be expressed by a correlation coefficient C obtained by the equation, lime requirement=C (specific acidity -1). The value of C is believed to be a measure of the adsorptive power of the soil colloids for H-ion. This coefficient has been found to vary so widely from one soil to another, from an untreated to a limed soil, and even from one depth to another in the same soil, that it is considered impracticable to calculate lime requirement from acidity determinations in general. It is thought that soils may be roughly classified on the basis of the value of C, a convenient ratio between classes being $\sqrt[3]{10}$.

The fixation of phosphoric acid by the soil, G. S. Fraps (*Texas Sta. Bul. 304 (1922), pp. 5–22*).—Studies on the relation of fixation to the properties of typical Texas soils, especially as regards the loss of phosphoric acid from fertilizers or the estimation of active plant nutrients in the soil, are reported.

A comparison of fixation at different temperatures showed that in some soils considerable increases took place when the temperature increased, and the fixation increased with the time of contact. The addition of salt to precipitate the clay had little influence upon the amount of phosphoric acid fixed. Treatment with acid to remove the calcium carbonate had little influence upon fixation in some soils, but decreased it considerably in others. Igniting the soil increased its power to fix phosphoric acid even when the lime had been removed by previous treatments with acid.

A number of minerals examined for fixation did not exhibit fixing powers high enough to explain fixation by soils. Soil minerals had greater fixing powers than minerals found in deposits. Soils having a fixing power of more than 50 per cent lost practically no phosphoric acid when treated with acid phosphate and subjected to percolation, while soils having a fixing power of less than 50 per cent lost considerable fertilizer phosphoric acid by percolation. A large part of the fixation took place in the soil column below the mixture of soil and fertilizer.

The amount of phosphoric acid in the percolate decreased as the time of contact between the soil and fertilizer increased before the water was applied. This is taken to indicate that heavy rains would be required to give a loss of phosphoric acid, even from soils of low fixing power, under natural conditions.

An examination of 761 surface soils and 651 subsoils showed that the percentages of iron and aluminum oxids increased as the percentages of phosphoric acid fixed increased. The correlation factor between the phosphoric acid absorbed and the percentages of iron and aluminum oxid dissolved from the surface soil was 0.774 ± 0.01 and for subsoils 0.701 ± 0.013. There was a close correlation between the phosphoric acid fixed by the soils and the quantities of iron and aluminum oxids dissolved by a strong acid from the soil. The correlation factor between the quantity of lime dissolved by a strong acid and the phosphoric acid fixed was 0.098 ± 0.024 and for the subsoil 0.06 ± 0.026. There was little correlation between the phosphoric acid absorbed by the soil and the amount of lime present.

A table is given showing the relative fixation of 1,413 Texas soils.

Influence of salts on bacterial activities of soil, J. E. Greaves (*Bot. Gaz., 73 (1922), No. 3, pp. 161–180*).—In a contribution from the Utah Experiment Station a summary of the results of studies on the subject is presented, which indicates that many salts when applied to a soil in small quantities increase its bacterial activities. This is manifested by an increased production of ammonia, nitrates, and soluble and organic phosphorus, together with an increased nitrogen fixation. Usually, although not always, those salts which become toxic in the lowest concentrations are the greatest bacterial stimulants.

A very close correlation is said to exist between the toxicity of the various salts and the osmotic pressure produced in the soil. This is taken to indicate that toxicity is due in part to osmotic disturbances. Another factor of equal importance is said to be the change in chemical composition of the protoplasm resulting from the formation of salts of the protein other than those normally occurring in the living protoplasm, thus incapacitating them for their normal functions.

A list of 39 references to literature bearing on the subject is appended.

Disappearance of nitrates from soil under timothy, J. A. Bizzell (*Jour. Amer. Soc. Agron., 14 (1922), No. 8, pp. 320–326*).—Studies conducted at the New York Cornell Experiment Station are briefly reported which showed that the addition of sodium nitrate to timothy sod in the early spring was followed by a rapid disappearance of the nitrate from the surface 8 in. of soil, and that this disappearance was due only in part to the absorption of nitrogen by the growing crop. The evidence obtained indicated that the discrepancy was not due to leaching nor to the removal of nitrogen from the soil by denitrification. It appeared likely that the nitrate unaccounted for was utilized by various soil organisms, and that it was therefore transformed to ammonia or some organic compound.

It is stated that, while the accuracy of the nitrogen balance sheet presented is subject to the limitations of the methods employed, the discrepancies observed were so greatly in excess of any probable inaccuracy of the methods that the

results seemed to justify the conclusion drawn and a continuation of the study under more rigidly controlled conditions.

Nitrate fluctuation in the Gangetic alluvium and some aspects of the nitrogen problem in India, G. CLARKE, S. C. BANERJEE, M. N. HUSAIN, and A. QAYUM (*Agr. Jour. India, 17 (1922), No. 5, pp. 463–475, pls. 2*).—Studies on the fluctuation of the nitrate content of the alluvial soils along the Ganges River are reported.

These studies are taken to indicate that under the ordinary system of cultivation in upper India conditions are favorable for rapid nitrate accumulation (1) immediately after the first rains of the southwest monsoon in June or July and (2) at the beginning of the cold weather season in October. These months coincide with the beginning of the two agricultural seasons and occur just before the sowing of the summer and the cold-weather crops. Both the summer and autumn periods of nitrate accumulation are said to be preceded by conditions unfavorable to active life in the soil. The summer period is preceded by the intensely hot and dry months, during which the upper surface of the soil is deprived of soil moisture. The autumn period is preceded by three months of excessive rainfall, during which the soil is frequently saturated with moisture.

A contribution to the study of the paddy soils of Ceylon and eastern countries, A. BRUCE (*Ceylon Dept. Agr. Bul. 57 (1922), pp. 54*).—The results of an examination of 54 samples of rice soils from the southern, central, northwestern, north-central, northern, and eastern provinces of Ceylon are presented and compared with the results of similar examinations of 65 samples of rice soils from Burma, India, the Federated Malay States and Straits Settlements, Siam, the Philippine Islands, and Japan. Soil samples were taken from the surface to 9, 18, and 24 in. and mixed.

It was found that Ceylon paddy soils contain a larger proportion of coarse soil than similar soils from other countries, the average coarse matter content being 63 per cent. Of the other countries the coarsest soils are those from south India, followed in order by those from Japan and the Philippine Islands. The average silt fraction of the Ceylon paddy soils was 24, and that of south India 29 per cent, while in the soils of the other countries it proved to be the predominating fraction, averaging from 48 to 55 per cent. Clay was not present in large proportions in any of the soils examined except in those from Burma and Siam. The average clay fraction in Ceylon paddy soil was 7 per cent. The conclusion is drawn that Ceylon soils are deficient in the finer soil particles and therefore in their powers for retaining water. Generally speaking, the paddy soils were not rich in organic matter and nitrogen but contained a good reserve of mineral plant nutrients, and were generally alkaline in reaction with the exception of those from the Federated Malay States and Straits Settlements and Siam.

Thus it is concluded that nitrogen is not a predominating factor in the cultivation of paddy. While the proportion of plant nutrients in rice soils is not actually deficient, it is thought that it should be greatly increased to make up for the lower proportion of fine soil or volume of feeding surface, which is deficient, especially in the Ceylon soils. Green manuring and rational fertilization to improve both the organic matter content and the content of nutrient materials are recommended.

Agriculture in the Shan States, with special reference to the system known as "taungya" cultivation, E. THOMPSTONE (*Agr. Jour. India, 16 (1921), Nos. 3, pp. 251–264; 4, pp. 396–405*).—The system of agriculture practiced in the Shan States lying east of Burma proper, covering about 57,000

square miles, is described, and studies of the so-called taungya system of cultivation are reported. In this practice the jungle growing on a piece of hillside land is cut down, and the brushwood with some of the smaller growth is heaped around the stumps and fired. The operation takes place during the dry weather. The soil is strongly heated, becomes brick colored, and a coating of wood ashes is left on the surface. The land is then cultivated for from 1 to 3 years and allowed to lie fallow for a considerable period, which may vary according to circumstances from 4 to 15 or 20 years or more. The beneficial effect of heat on the soils is apparently that of partial sterilization. Liming and manuring, together with green manuring, were found to produce the same or better results and to prevent the enormous waste of timber by the taungya process.

The reclamation of the desert area of the Kapurthala State, D. R. Sethi (*Agr. Jour. India, 17 (1922), No. 6, pp. 546–550, pl. 1*).—A description is given of the methods used in the reclamation of a 100-acre tract of light, sandy desert soil typical of the desert soils of the State of Kapurthala. The treatment consisted primarily of obtaining a water supply for irrigation, increasing the organic matter content by growing green manure crops, and the addition of clay to improve the cohesive properties of the soil and increase its potential supply of plant nutrients.

The use of different proportions of ammonia, phosphoric acid, and potash (*Ohio Sta. Bul. 362 (1922), pp. XX, XXI*).—Studies conducted during eight years to determine the best proportions of ammonia, phosphoric acid, and potash on Wooster silt loam soil are reported.

These showed that phosphorus is the most important element, and that it is only when more than 500 lbs. of acid phosphate per acre per 4-year period is used that it pays to add any nitrogen to a fertilizer carrying phosphorus or potassium.

Where can stable manure be used to best advantage? (*Ohio Sta. Bul. 362 (1922), pp. XIX, XX*).—Experiments with stable manure reinforced with 60 lbs. of 16 per cent acid phosphate per ton to determine where it can be used in ordinary farm rotations with greatest profit are briefly reported. The standard application was 8 tons of manure and 480 lbs. of acid phosphate per acre for four years, divided equally between corn and wheat in one set of four plats, being plowed under for corn and applied to wheat as a top-dressing before drilling. In another set the combined application was plowed under for corn, and in still another all was applied as a top-dressing for wheat, and finally it was used as a top-dressing on the new seeding of clover, applied soon after the wheat harvest.

The results thus far have indicated that it was most profitable to put the manure and the phosphate on the wheat and least profitable to put it on the new seeding of clover.

Lime requirements of New Hampshire soils (*New Hampshire Sta. Bul. 208 (1923), p. 19*).—Data on the lime requirements of representative soil samples from eight counties in New Hampshire, as determined by the Truog method, are briefly presented.

[Limestone studies in Ohio] (*Ohio Sta. Bul. 362 (1922), pp. XV, XVI, XVIII*).—Experiments conducted during two 4-year rotation periods to study methods of applying limestone showed that there is apparently little choice between applying limestone before or after plowing ground for corn or as a preparation for wheat. Liming the new seeding of clover was not as satisfactory as liming at other times in the rotation. The application of lime on sod

before plowing for corn gave quite satisfactory results and was the cheapest and most convenient method of application.

Experiments to compare fine ground limestone with a commercial grade of 0.25-in. screenings when applied at rates of 2 and 4 tons per acre under uniform conditions to ground plowed for corn are briefly presented. As an average of 8 years' work, 4 tons of the screenings gave a larger increase than 2 tons of the fine limestone. This is taken to indicate the importance of striking an economic balance in the use of these materials.

It is stated that where limestone was applied 6 years previously at the rate of 6,000 lbs. per acre, 62 per cent of that ranging from $\frac{1}{4}$ to $\frac{1}{8}$ in., 24 per cent of that ranging from $\frac{1}{8}$ to $\frac{1}{20}$ in., and 17 per cent of that ranging from $\frac{1}{20}$ to $\frac{1}{80}$ in. remained in the soil, while where finer stone than these was applied 5 per cent remained.

Lime as an amendment, R. Menéndez Ramos (*Porto Rico Dept. Agr. and Labor Sta. Circ. 74 (1923), Spanish ed., pp. 3–17, figs. 4*).—Practical information on the use of lime as an amendment for Porto Rico soils is given in this circular, special attention being drawn to its influence on certain crops.

The effect of borax on the growth and yield of crops, J. J. Skinner, B. E. Brown, and F. R. Reid (*U. S. Dept. Agr. Bul. 1126 (1923), pp. 31, pls. 11*).—A continuation and extension of cooperative field studies on the effect of borax upon different crops on several important types of soil in the States of Maine, New Jersey, Virginia, and Alabama are reported (E. S. R., 42, p. 816).

The results in general showed that borax was harmful to plant growth, and that potatoes can tolerate a greater quantity of borax than plants like corn or beans, which are injured by comparatively small quantities of this material. The degree of injury, however, was modified considerably according to the rainfall, and apparently the depth and distribution of rainfall is the most prominent factor concerned. Heavy rainfall in one section caused the borax to leach into the soil mass, thereby enabling plants to withstand greater applications of it than in other sections where less rainfall had occurred and where only light applications were necessary to produce injury.

The manner in which the fertilizer was applied exerted considerable influence, and in practically every case the fertilizer-borax mixtures drilled in the furrow, followed by immediate planting, produced much worse injury and with lower concentrations than when they were applied some time before planting or where broadcasted immediately before planting.

The effect of borax on the germination and yield of Lima beans at Arlington, Va., was most noticeable where the fertilizer-borax mixtures were applied in the furrow and planting done at once. Less than 50 per cent germinated with an application of 10 lbs. of borax per acre, and with even less quantities the effect was marked. The 10-lb. application of borax caused marked depression in the final yield of both vines and beans. In the section where the mixtures were sown broadcast, it required 20 lbs. to produce injury, while in the section where the fertilizer-borax mixtures were applied in the drill some time before planting, 20 lbs. also were required to produce injury.

The effect of borax on snap beans was quite marked, injury being noticeable with small quantities of borax. The yield was curtailed with an application of 5 lbs. of borax per acre, and with quantities below 5 lbs. the vines showed a color lighter than the no-borax plats.

The effect of borax on potatoes when used in quantities less than 5 lbs. per acre was one of stimulation. Where the borax application immediately preceded planting, 20 lbs. of the borax produced injury and a depression in yield. With the other methods of applying the borax mixtures the potato withstood greater concentrations.

Corn displayed a marked reaction to borax. In the case of immediate planting, where the fertilizer was drilled in the furrow, only 2 or 3 lbs. of borax were required to produce lighter colored plants, and with 5 lbs. marked discoloration ensued. When the fertilizer was sown broadcast no discoloration took place until 10 lbs. or more of borax per acre had been applied. Four pounds of borax in the drill depressed the yield of both stover and corn. When sown broadcast, 20 lbs. were required to depress the yield. Practically no plant growth took place where the application exceeded 50 lbs. of borax per acre.

The effect of borax on cotton in experiments conducted at Arlington, Va., and Muscle Shoals, Ala., was to injure severely the plants with 20 lbs. of borax per acre and to injure slightly the plants with 10 lbs. per acre. With high rainfall the degree of injury was slight, and with low rainfall the injury was more severe.

In experimental work in Virginia, New Jersey, and Maine the effect of borax was more marked on sandy soils than on the heavier soil types, and the effect of the borax was modified by rainfall.

Experimental work conducted at New Brunswick, N. J., with corn and potatoes on Sassafras loam showed strikingly the influence of rainfall, for it required comparatively light initial applications of borax to produce the degree of injury noted elsewhere.

The experiments on Caribou loam in Maine showed that 5 lbs. of borax applied in the drill at the time of planting produced definite injury, but the methods of applying the fertilizer-borax mixtures, such as early application before planting and broadcasting, tended to reduce the degree of injury at the lower concentrations. While there was evidence of borax remaining in the soil for a period of some months even with considerable rainfall, the injury was practically confined to the drill rows with high initial applications of borax. In a commercial field under observation no injury could be observed the second year after the failure of the cotton crop caused by borax in the fertilizer used.

In all of the work where comparisons were made, it was shown that the potash salt from Searles Lake, Calif., when practically free from borax, gave satisfactory results as measured by actual yields.

Analyses of commercial fertilizers and ground bone; analyses of agricultural lime, C. S. CATHCART (*New Jersey Stas. Bul. 376 (1922), pp. 54, fig. 1*).—This bulletin, supplementing Bulletin 371 (E. S. R., 48, p. 623), contains guaranties and actual analyses of 222 samples of commercial fertilizers and ground bone, 16 samples of sundry materials, and 21 samples of agricultural lime collected for inspection in New Jersey during 1922, together with a discussion of the inspection for the entire year. It is stated that of the 1,528 possible deficiencies in the 526 brands examined during the year, 231 or 15.1 per cent were found. Of these deficiencies 123 were in nitrogen, 56 in phosphoric acid, and 52 in potash. These were distributed through 205 brands, 183 brands being deficient in one element, 18 brands in two elements, and 4 brands in all three. It is stated that the record for the year is about the worst that has been reported for many years, in that 39 per cent of the brands did not substantially satisfy the guaranties.

Composition and prices of commercial fertilizers in New York in 1922, L. L. VAN SLYKE (*New York State Sta. Bul. 499 (1923), pp. 3–21*).—This bulletin comprises a general review of the status of the various classes of commercial fertilizers in New York during 1922, and includes a comparison with pre-war conditions and with changes noted during the years following the

war. It is stated that with respect to the kinds of materials offered for sale, the composition of fertilizer mixtures, and the cost of plant nutrients contained in commercial preparations the gradual return to pre-war conditions noted during the past two or three years continued through 1922 to a marked degree.

AGRICULTURAL BOTANY.

Further studies in photoperiodism, the response of the plant to relative length of day and night, W. W. GARNER and H. A. ALLARD (*Jour. Agr. Research [U. S.], 23 (1923), No. 11, pp. 871–920, pls. 19*).—Crediting the appropriate term "photoperiodism" to O. F. Cook as used to designate the response of the plant to length of day, the authors present data tending to demonstrate the importance of the seasonal range in length of day as a factor in initiating and regulating sexual reproduction in plants, thus confirming the results of investigations reported earlier (E. S. R., 45, p. 730). Experiments are described also bearing on certain quantitative aspects of this response. Results of fairly extensive investigations on the relation of length of day to the formation of tubers and bulbs are presented in some detail. Observations, largely preliminary, are reported on length of day as a factor in various other responses of the plant, including character and extent of branching, root growth, formation of pigment, abscission and leaf fall, dormancy, and rejuvenescence. Apogeotropic growth or increase in stature as affected by the daily light period is given somewhat detailed consideration in its apparent relation to flowering and fruiting and other responses.

It appears that the duration of the daily illumination period may not only influence the quantity of photosynthetic material formed but also may determine the use which the plant can make of this material. The evidence now available indicates that for each species there is an optimal light period for maximum upward elongation of the stem or increase in height. Certain species are caused to die back, form bulbs, and enter into a midsummer rest period.

Further reduction of the light period by a sufficient decrement below the optimal for sexual reproduction tends to induce intense tuberization, a feature marking the final stages in reduction of stem elongation. There is a more or less clearly defined optimum for tuberization. Tuberization as a result of decrease in the daily light period involving deposition of carbohydrate in relatively condensed or dehydrated forms indicates marked loss of power to utilize the product of photosynthesis in elongating the stem or in developing flower and fruit. It is most typically associated with the stemless or rosette form of foliage development, representing, perhaps, maximum divergence between income and effective utilization of the photosynthetic product for promotion of growth.

One of the characteristic effects of change in the light period from optimum to suboptimum for stem elongation is to promote branching. The decreasing length of day in fall is an important factor in causing perennials to enter upon the winter period of dormancy. Abscission and leaf fall also appear to be induced by this shortening of the light period.

During the winter months the relation between the length of the daily light period and the temperature becomes especially important. Because of the short days prevailing in this period the income of the plant through photosynthesis is reduced to the minimum and growth conditions are otherwise unfavorable, so that high temperatures are likely to establish an unfavorable ration of income to outgo and thus may easily prove disastrous to the plant.

It is considered probable that the annual cycle of length of day, affording as it does the only consistently rhythmic feature of the external environment,

is a dominant causal factor in phenomena of plant periodicity which have been regarded by many as explainable only on the basis of an internal rhythm. The internal mechanism concerned in the marked regulatory action of the length of day on plant growth has not been fully determined, but there is strong evidence that in some way the degree of hydration of the living cell content is brought under very delicate control by the ratio of the number of hours of sunlight to the number of hours of darkness in the 24-hour period.

Winter injury to apple roots (*New Hampshire Sta. Bul. 208 (1923), pp. 6, 7*).—In a further report (E. S. R., 47, p. 450) regarding the freezing of apple roots and the prevention of root injury due to cold, results obtained by G. F. Potter indicated that it is not feasible through soil manipulation to reduce winter injury, except in so far as penetration of the soil by frost may be hindered by use of a mulch or cover crop. Different seedling roots vary widely in resistance to cold, but scion roots are much more hardy. The environmental conditions during freezing, such as length of exposure to cold temperature, the rate of temperature fall within limits which are possible under field conditions, and the rate of thawing after freezing, appear to be of relatively small importance, the amount of injury depending most largely upon the degree of temperature to which the roots are subjected.

Accumulation of aluminum and iron compounds in corn plants and its probable relation to root rots, G. N. Hoffer and R. H. Carr (*Jour. Agr. Research [U. S.], 23 (1923), No. 10, pp. 801–824, pls. 21*).—The results reported in this paper have been obtained in investigations conducted jointly by the Office of Cereal Investigations, Bureau of Plant Industry, U. S. D. A., and the Indiana Experiment Station.

One of the most common characteristic differences between normally growing corn plants and those which become severely root rotted is the condition of the vascular plate tissues in the nodes of the stalks, the plants in the latter case becoming discolored and disintegrated. This disintegration begins in the absence of specific organisms. The discolorations have been produced artificially by injecting solutions of certain salts of aluminum and iron into the plants. Definite chlorophyll and leaf-tissue changes have also been produced, though other factors may operate to produce similar results. It is stated that these artificially induced changes closely resemble the phenomena in plants growing under conditions favorable to root rots. The most severe cases of root rots have been found in soils notable because of their deficiencies of lime and available phosphates. Such soils have variable quantities of salts of aluminum and iron available for absorption. Corn plants show marked differences in the quantities of aluminum and iron salts which they absorb.

A definite cumulative toxicity of aluminum salts within the plants was established by the injection experiments, and it is believed that the same phenomenon occurs naturally in the field. The relative quantities of the available metals and of nitrates in the soil determine, in a large measure, the rate of development of the cumulative toxicity of the metals within the plants. Those plants which contain the largest quantities of these metals are the ones which seem to develop the most severe cases of root rots when the organisms are present in the soil and the meteorological conditions favor their optimum growth. When abundant aluminum injuries occur in the corn plants in certain fields it is an indication that the soil is deficent in available phosphates.

The application of lime and phosphates to soils in which root rots have developed in destructive proportions has been decidedly beneficial in controlling them. The use of limestone alone in some instances proved harmful, but in all cases studied so far the application of available phosphates produced plants which were better and more resistant to the root rots.

How Bordeaux mixture stimulates plants (*New Hampshire Sta. Bul. 208 (1923), pp. 12, 13*).—During the past year the studies on the stimulatory action of Bordeaux mixture have been completed, the investigations by O. Butler in this field having shown that the physiological response of plants to the mixture depends on the intensity of the shadow cast by the wash, the amount of lime present in the mixture thus proving to be the important factor. A milk of lime wash of the same strength in lime as a 1–1 Bordeaux mixture had practically the same effect upon the sprayed plant as the latter. The fertility of the soil in which the plants were growing did not affect the response obtained, though spraying with a 1–1 mixture had a beneficial effect on the plants grown in soil much too dry for normal development.

The increased transpiration that occurs at night is not the cause of the differences in behavior observed between sprayed and nonsprayed plants. The effect of Bordeaux mixtures and milk of lime on plants at night is, therefore, less important than the effect produced by these washes during the day. In fact, it was observed that sprayed plants do not necessarily transpire more actively during the night. Evidently Bordeaux mixtures and milk of lime possess under conditions of darkness properties in common and under conditions of sunlight dissimilar properties. Under conditions favorable for radiation at night, sprayed plants should transpire more than nonsprayed plants, and it was found that they actually did so.

FIELD CROPS.

Crop rotation under irrigation, J. A. Holden (*Nebraska Sta. Bul. 190 (1923), pp. 11, fig. 1*).—The essentials and advantages of a good crop rotation are pointed out, and rotation experiments under irrigation at the Scottsbluff Substation in cooperation with the U. S. Department of Agriculture are summarized. The comparative yields of sugar beets, potatoes, and other crops on unmanured and manured land and after alfalfa have been noted earlier (E. S. R., 45, pp. 530, 531; 47, p. 736).

On an acre basis, potatoes grown continuously on the same land showed an estimated loss of more than $42, while potatoes grown on alfalfa land in 6- and 7-year rotations made a net profit of $75. The average loss from all the potatoes grown in the rotations of 3 years or less amounted to more than $35 per acre, while those grown on alfalfa land in the longer rotations yielded a net profit in excess of $50. Sugar beets in rotations without alfalfa, sweet clover, or manure showed a small loss, but when in rotations with either legume crop or receiving manure, they returned a net profit of between $20 and $40 per acre. Corn varied from a small loss in the poor rotations to a net profit of $12 per acre when grown on alfalfa land. Small grain always suffered a loss from the poor rotations and seldom showed a profit from the good ones.

All one-crop systems showed a financial loss, varying from $192 with corn to $3,234 with potatoes. All rotations omitting alfalfa showed a loss, except a 2-year rotation of oats and sugar beets manured. Every rotation having alfalfa was profitable in spite of the fact that the alfalfa crop showed a loss in the shorter rotations.

[**Report of field crops work in New Hampshire, 1922**] (*New Hampshire Sta. Bul. 208 (1923), pp. 15–19*).—Results are briefly noted of experiments with field crops (E. S. R., 47, p. 428), carried on by F. W. Taylor, M. G. Eastman, and H. R. Kraybill, which included timothy improvement work, varietal tests with silage corn and red clover, rejuvenation of land continuously cropped to hay for long periods, top-dressing hay land with nitrogenous salts,

potash tests with potatoes, and pasture improvement studies. Analyses of silage from 17 corn varieties are tabulated.

[Field crops work in Ohio] (*Ohio Sta. Bul. 362 (1922), pp. XI–XIII, XIII, XIV, XXIII*).—Late application of from 1 to 2 tons per acre of straw mulch has excelled the early application somewhat, although neither has been justified by increased yields of wheat during a 5-year period. The mulch seemed to slightly depress the yields of clover hay following the clover seeding in the wheat. Wheat grown for 7 successive years in 27 different rotations has averaged 31.47 bu. per acre after corn, 34 bu. after soy beans, 34.69 bu. after oats, 34.98 bu. after clover, and 36.96 bu. after potatoes.

In a 10-year comparison alsike clover has averaged 2.64 tons per acre, white sweet clover (biennial) 2.6 tons, mammoth red clover 2.29 tons, yellow sweet clover 2.12 tons, and medium red clover 2.02 tons. The average acre yield of the mixture of red, alsike, and white sweet clover was less than the average yield of the three grown separately in 3 of 4 years. A similar mixture of red clover, alsike, and alfalfa made slightly higher yields (one cutting only) 2 years in 3, than the average of each grown separately, and uniformly outyielded alfalfa seeded alone. A mixture of red, alsike, and white sweet clover was slightly outyielded by a mixture of red, alsike, and alfalfa. Results have been most satisfactory in the improvement of permanent pastures on county experiment farms when the ground has been plowed, good seed beds prepared, fertilizer applied, and several varieties of grasses and clover sown. Manure improved the variety of the herbage, partly because of seeds carried by the manure. Close grazing did not prevent weed growth, but clipping the pasture in June and August of each year improved the grass and checked weeds.

The returns from a 4-year rotation of potatoes with phosphated stubble, corn, wheat, and clover with sod manured were 10.7 per cent greater in value than where the order and treatment of the potatoes and corn were reversed.

[Field crops work in Ireland, 1922] (*Ireland Dept. Agr. and Tech. Instr. Jour., 22 (1923), No. 4, pp. 345–359, 378–385*).—Experiments with field crops are reported in continuation of earlier work (E. S. R., 47, p. 32).

[Report of field crops work in New South Wales, 1918–1922], A. H. E. McDonald, J. T. Pridham, and E. Breakwell (*N. S. Wales Dept. Agr. Rpts., 1918, pp. 22–27, 30–32; 1919, pp. 23–32, 36–38; 1920, pp. 25–37, 40–42; 1921, pp. 21–23, 29, 30; 1922, pp. 2, 10*).—These pages report the results of varietal, cultural, and fertilizer trials (E S. R., 40, p. 524) with wheat, corn, oats, and potatoes; variety tests with sweet corn and popcorn; fertilizer trials with alfalfa, millet, and Sudan grass; field trials of miscellaneous grasses and clovers, alfalfa, and grain and forage sorghums; and breeding work with wheat, barley, oats, rye, and field peas.

The fiber value of the stems of edible bananas, M. Halama (*Faserforschung, 2 (1922), No. 4, pp. 272–276*).—The fiber of *Musa cavendishii* compares favorably with the best manila hemp for cordage, and its use for firm, fine, and silky fabrics is considered possible.

[Continuous selection of corn for special characteristics] (*Illinois Sta. Rpt. 1922, pp. 15, 16*).—In the twenty-fifth (1921) generation, the high protein strain of corn averaged 16.66 per cent protein and the low protein strain 9.13 per cent, and the high and low oil strains 9.94 and 1.7 per cent oil, respectively. The high protein and high oil strains were higher and the low oil lower than in any previous crop, indicating that the chemical composition of those strains is still being modified. The high yield strain yielded 26 per cent more than the low yield strain, but only 2.6 per cent over the nonpedigree strain, which continues to give yields comparing very favorably with those obtained by the

ear-to-row method. The average height of the ear of the 1921 crop was 96 in. in the high-ear plat and 14 in. on the low-ear plat, as compared with 78.9 and 11.8 in., respectively, for the 1920 crop. The percentages of 2-eared stalks were 69.8 in 1921 and 54 in 1920.

Self- and open pollination of corn, V. MANDEKIĆ (*Poljoprivredni Glasnik-Novisad; abs. in Ztschr. Pflanzenzücht., 9 (1923), No. 1, p. 69*).—During seven years' work at Krizevci the progeny of self-pollinated corn plants, as compared with the progeny of open-pollinated corn, grew and developed slower and had weak and inferior stalks with ears that were shorter, smaller in circumference, and with fewer rows. The ears on progenies of self-pollinated plants were fewer, and with accompanying smaller weights of ears, grain, cobs, husks, and 1,000 kernels. The progenies of selfed plants included many sterile plants, which increased in frequency with the continuation of selfing. Permitting open pollination of stock selfed for several generations resulted in striking increases in growth, development, yield, and other characters.

Corn varieties for chinch bug infested areas, W. P. FLINT and J. C. HACKLEMAN (*Illinois Sta. Bul. 243 (1923), pp. 539–550, figs. 6*).—Champion White Pearl, Democrat, Black Hawk, and, except one year, Golden Beauty far outyielded other corn varieties from the Corn Belt, Plains, and Northwest in experiments in the presence of from moderate to severe chinch bug (second brood) infestation in southern Illinois. Field observations during the course of the comparisons suggest that the greater yield of certain varieties is due to plant vigor as manifested by certain varietal characteristics, such as large and sturdy stalks, well-developed root systems, and large leaf surfaces. Marked differences were not observed in the number of bugs present on the different varieties of corn when growing together, and apparently some varieties are resistant to injury and are not merely distasteful to the bugs.

Champion White Pearl and Democrat, practically synonymous, Black Hawk, and Mohawk have also been outstanding in varietal tests under infestation in southern Illinois. In an 8-year test, during which no bugs were present, Reid Yellow Dent and Funk Ninety Day averaged somewhat higher in yields but with grain of much lower quality than Champion White Pearl. The resistant strains have also ranked close to standard Corn Belt varieties in tests reported from central Illinois. Brief descriptions of the less common varieties are included.

Cotton experiments, 1922, South Mississippi Branch Station, E. B. FERRIS (*Mississippi Sta. Circ. 46 (1923), pp. 6*).—Varieties outstanding in acre yields and values included Lone Star 65 and strains of Trice and Delfos. The tabulated results of fertilizer trials showed enhanced yields of seed cotton to accrue from the use of lime. Neither the appearance of the plants nor yields were different whether the fertilizer was applied deep, medium, or shallow. The use of potash in the form of kainit is said to have enabled plants to retain foliage throughout the season. Yield differences were slight whether potassium sulphate or potassium and magnesium sulphate was used, and marked reductions did not accompany the omission of potash. The importance of nitrogen and phosphorous was indicated by the substantial reductions in yield where either was omitted.

Summer irrigation of Pima cotton, R. D. MARTIN and H. F. LOOMIS (*Jour. Agr. Research [U. S.], 23 (1923), No. 12, pp. 927–946, figs. 4*).—Experiments were conducted at Sacaton, Ariz., by the Bureau of Plant Industry, U. S. D. A., to determine the effects of different frequencies of irrigation during July and August on Pima Egyptian cotton that had reached a normal early fruiting stage. The treatments included normal irrigation, or the application of water so as to keep the plants flowering heavily and with little or no wilting in the

middle of the day; a "heavy" border, receiving irrigations at frequent intervals regardless of the condition of the plants or soil; and an intermediate irrigation treatment.

The different frequencies of irrigation after the plants had reached a normal fruiting stage did not cause any consistent significant difference in growth or yields, nor did the rates of flowering or of shedding of young bolls vary consistently under any of the treatments. A wide range in the daily flowering production occurred, and the rate of shedding of young bolls also varied from day to day. Correlation between these fluctuations and factors which might be supposed to influence this phenomenon could not be definitely established. No consistent increase or decrease at a regular interval after an irrigation was found either in the flowering or in the shedding of young bolls. Shedding of young bolls was greatest from 4 to 14 days after flowering. The shedding of flower buds, or "squares," was almost negligible throughout the experiment. The yield differences found are ascribed to soil heterogeneity rather than to the different frequencies of irrigation or to the loss of bolls by shedding.

The importance of controlling the early development of cotton in order to bring the plants to a normal early fruiting stage is emphasized. When this condition is attained, the summer irrigation problems are simplified, since the plants are not so easily forced into rank growth by the application of water in excess of the actual requirements.

Spinning tests of cotton compressed to different densities, W. R. Meadows and W. G. Blair (*U. S. Dept. Agr. Bul. 1135 (1923), pp. 19, pls. 5, figs. 4*).—Spinning tests with pure strains of Cleveland, Rowden, Delta, and Webber 49 cotton were made to determine if compressing to higher densities than 15 lbs. per cubic foot injures the spinning value of the cotton. Grown and handled under nearly uniform conditions, the lint of each variety was compressed into a flat bale, a standard or railroad compressed bale, and a high-density bale. High-density bales of Cleveland and Webber 49 compressed while wet and a round bale of Rowden were also included.

Compressing cotton to standard or high density when in a dry or normal condition did not appear to impair its spinning value. Compressing wet cotton to high density increased the percentage of waste about 2 per cent with both Cleveland and Webber 49, and also caused a decrease in the breaking strength of about 12 per cent in the yarn of Cleveland but did not materially affect Webber 49 in this regard. The yarns spun from the round bale of Rowden were about 7 per cent weaker and slightly more uneven than the yarns spun from the other types. If the round bale were to be run continuously in a mill, special opening equipment would be needed.

Official report [of] the Eleventh International Cotton Congress (*Manchester, Eng.: Com. Internatl. Fed. Master Cotton Spinners' and Mnfrs. Assocs., 1922, pp. 256, pl. 1, fig. 1*).—A report of the proceedings of the Eleventh International Cotton Congress of Delegated Representatives of Master Cotton Spinners' and Manufacturers' Associations held at Stockholm, June 14–16, 1922. Among the papers presented were The Courts of Arbitration of the International Cotton Federation, by J. Taylor; The Testing of Raw Cotton as Regards Humidity, by A. Mabire; Cotton Supply, Distribution, and Consumption, by N. S. Brown; Present State of Cotton Growing in the Congo, by R. Mees; Possibilities of Cotton Cultivation in the State of Ceará, Northeast Brazil, by I. Albano; Cotton Cultivation in the British Colonies, by J. M. Thomas; Cotton Growing within the British Empire, by L. G. Killby; Cotton Cultivation in China, by U. L. Sun; The Egyptian Cotton Crop from 1898 to 1921, by W. L. Balls; The Work of the French Colonial Cotton Growing Association, by

Noguès; Cotton Growing in Italian Somaliland, by G. Mylius; and Cotton Growing in Spain.

Frost resistance in flax, R. L. Davis (*U. S. Dept. Agr., Dept. Circ. 264 (1923), pp. 8, figs. 5*).—Subjecting flax seedlings from several varieties to temperatures from 19 to 32° F. gave evidence that the best temperature range for frost-resistance tests with flax is from 21 to 24°. Frost injury is first noticeable in the flax hypocotyl, and unless the temperature falls below the range of frost resistance the cotyledons and root system are affected only indirectly.

Different varieties varied consistently in the degree of injury from frost, White Blossom Dutch being usually so injured that the entire hypocotyl of every plant was withered, whereas hypocotyl injury could scarcely be detected in Saginaw or Blue Blossom Dutch. Observations on 15 kinds of flax indicated that as a rule the flaxes most resistant to frost are also strongly resistant to flax wilt. The performance of reselections from the more resistant of tall fiber-flax selections showed that in each case improvement over the parent stock had been secured.

Effect of Andropogon sorghum on succeeding crops of Triticum sativum vulgare, M. C. Sewell (*Bot. Gaz., 75 (1923), No. 1, pp. 1–26, figs. 12*).—Winter wheat grown after kafir produced an average of 3 bu. less grain per acre than wheat after corn during six years' tests at the Kansas Experiment Station. Differences in the forage production, the draft on the plant food in the soil, liberation of soil nitrogen, and the soil moisture did not explain the effect of kafir in depressing the wheat yield. Water culture studies after the method of Schreiner and Skinner (E. S. R., 24, p. 32) did not reveal any toxicity in kafir soil solutions.

Where wheat in pot cultures received its moisture solely from water percolating through perforated trays in which kafir and corn were grown, the growth of kafir plants inhibited the development of the wheat. When kafir and corn were grown in the percolating trays, harvested, and wheat planted where it would receive the drainage from the trays, the kafir soil trays depressed the growth of wheat, indicating the existence of decomposition products from the crop residue which influence the growth of wheat.

The potato, K. Snell (*Die Kartoffel. Freibury i. Br.: Theodor Fisher, 1922, pp. [4]+96, figs. 26*).—Part 1 of this publication embraces concise accounts of the European history of the potato, its related species, structure of the plant and organs, life cycle, biology of propagation, potato improvement and breeders in Germany, and diseases and their control. The second section discusses the utilization of the crop, includes statistics of production, and outlines cultural and field methods and storage requirements.

Report of the Potato Association of America (*Potato Assoc. Amer. Proc., 9 (1922), pp. 112, pl. 1*).—A report of the ninth annual meeting of the association, held at Boston in December, 1922, outlining the activities of the organization and of its committees in 1922. Among the papers included are Some Recent Aspects of Potato Variety Testing, by E. V. Hardenburg; A Preliminary Study of Field Plat Technique in Potato Yield Tests, by F. A. Krantz; Summary of Seed Potato Certification in the United States and Canada in 1922, by A. G. Tolaas; Methods in the Improvement of Seed Potatoes, by F. R. Perry; Seed Potato Certification in Michigan, by H. C. Moore; Sterility Studies, by C. F. Clark; and Some Physiological Aspects of Potato Storage, by C. O. Appleman.

Fertilizer, variety, and seed selection experiments on Irish and sweet potatoes, T. H. White (*Maryland Sta. Bul. 251 (1923), pp. 23*).—The effect of continuous selection for seed of large, medium, and small tubers of the late varieties of Irish potatoes was studied at Ridgely and College Park. The

medium size gave the best average yields during 5 years at Ridgely with 3 varieties. After the fifth year the percentage of culls from the continuously selected large tubers of white McCormick was greater than from the small. The small seed made the best yield at College Park, except when all sizes were planted whole, and then the large size did the best, presumably on account of the larger set. Crimson Beauty averaged highest among varieties compared and was first in 1921 during a protracted drought. White McCormick was next in yield.

Fertilizer tests indicated that on good land, especially in a dry summer, no profit would accrue from the application of nitrogen, and very little, if any, from the application of acid phosphate. On the poorer soils both phosphoric acid and nitrogen would make profitable increases, particularly with abundant rainfall. However, if the soil is to be kept fertile, both nitrogen and phosphorus must be supplied.

Data from an experiment of 18 years' duration show the advantage of using fertilizers in growing Big-Stem Jersey sweet potatoes, stable manure giving an average annual profit of $38.53 per acre and commercial fertilizers $26.70. Continuous planting of sweet potatoes on the same soil did not result in an apparent injury to the land, a toxic effect, or an accumulation of diseases.

Permanence of variety in the potato, F. A. KRANTZ (*Jour. Agr. Research [U. S.], 23 (1923), No. 12, pp. 947–962, pl. 1*).—Seven lots of Early Ohio potatoes, representing differences in the amount of selection practiced by growers and distinct regional types, were obtained from growers at seven points in Minnesota and were grown in comparison with each other at University Farm, Duluth, Grand Rapids, and Crookston, Minn.

The results of the 4-year test did not show significant yield differences between the lots and the selected seed stocks were evidently not superior in vigor to the unselected seed stocks. A decided correlation was noted between the width and the length of tuber, and this correlation was similar for both small and large tubers of the same lots. The ratio of width to length of tuber was found to be a fairly good index by which differences in form could be detected in the Early Ohio variety, and moreover furnished a mathematical expression by which the form of tubers grown under different conditions and during different seasons could be compared.

Although the original lots differed considerably in form, the growth conditions at each place produced a uniform distinctive form of tuber. At Grand Rapids seasonal conditions affected the form, while at University Farm sandy loam and clay loam soil types produced distinct differences of form. No correlation was observed between form and yield. Knobs, fissures, prominence of lenticels, depth of eyes, prominence of eyebrows, and color of tubers were found to be unexpressed, expressed, or modified in expression according to the environment under which the tubers developed, but the expression of these characters on the tuber was influenced neither by selection nor by the environmental conditions surrounding the development of the seed stocks. Potato varieties apparently do not run into definite strains and are relatively stable under vegetative propagation. The author feels that from the evidence presented the method of asexual selection does not offer reasonable hope for their further improvement.

The status of the soy bean crop in Ohio, L. E. THATCHER (*Ohio Sta. Mo. Bul. 8 (1923), No. 3–4, pp. 59–64*).—A summary of replies to questionnaires submitted to soy bean growers in the State shows the modes and ranges of the acreages of soy beans grown; yields in comparison with other crops; choice of varieties for specific purposes; dates, rates, and methods of seeding; cultivation practices; cost of preparing seed for the seed trade; time and method of

harvesting; method and cost of threshing; and cultural methods and results with the corn-soy bean combination for silage. The oil and protein contents are tabulated for 61 varieties.

A new method of planting sugar cane, M. CALVINO (*Rev. Agr., Com. y Trab. [Cuba], 6 (1923), No. 6, pp. 34–39, figs. 6*).—In accordance with the Ferrer or "jan" method of seeding sugar cane, the cutting is placed nearly vertical with the uppermost bud about 20 cm. (8 in.) below the surface and the lower end from 30 to 40 cm. deep. Germination is said to be thus facilitated and moisture conserved. Plantings by this method averaged about 145 per cent more cane per unit area than the ordinary method. Analyses by G. M. Fortún and E. Babé showed cane grown by the Ferrer system to have a slightly lower purity and content of sucrose and slightly more fiber than with the ordinary method.

Sweet clover for summer pasture and green manure, J. E. METZGER (*Maryland Sta. Bul. 253 (1923), pp. 37–46, figs. 2*).—Cultural methods and field practices are recommended for the growing of sweet clover for hay, pasture, and green manure, and the results of experiments with the crop are reported.

The results obtained show that sweet clover may be used very profitably as an intermediate green manure or summer pasture crop between two crops of wheat. Although either fall or spring plantings may be made, the early spring plantings were more successful than fall seedings in the tests. Based on the average green weight yield during 3 years, 7.12 tons per acre, the average crop would contain 73.8 lbs. of nitrogen, 13.7 lbs. of phosphoric acid, and 52.7 lbs. of potash for green manure.

Under Maryland conditions, Hubam clover does not seem to have any advantage over the biennial white sweet clover for either hay, summer pasture, or green manure.

History and status of tobacco culture, W. W. GARNER ET AL. (*U. S. Dept. Agr. Yearbook 1922, pp. 395–468, figs. 28*).—A comprehensive account of the tobacco industry, embracing data on production and distribution, and touching upon the historical and geographical development, factors influencing production, cost of production, financing the crop, marketing, commercial movement, domestic consumption, international trade in unmanufactured tobacco, and import duties and internal revenue taxes on tobacco.

A high degree of specialization has accompanied the comparatively steady expansion in acreage and production of tobacco during and since colonial days. Tobacco culture has become sharply localized, with each producing section supplying a definite type peculiarly suited for specific trade purposes. These distinctive types are largely noncompetitive, so that important economic changes or tendencies may have very different effects on the various centers of production. Since the trade usually looks to some particular section producing tobacco of known characteristics for the required supply of each of the commercial types of leaf, and commercial tobacco culture in new territory must be at the expense of the established producing districts, under ordinary circumstances tobacco probably could not be grown with profit in sections where it is not at present a commercial crop.

Considering the tobacco crop as a whole there has been marked and almost continuous increase in production during the past 40 years, the rate of increase more than keeping pace with the increase in population. Under a well-balanced system of diversified farming, including winter feeding of steers, the acre yield of tobacco shows an upward tendency, whereas in a highly intensive one-crop system, heavy fertilizing and manuring is apparently failing to maintain yields at the first high levels. With an extensive system on rather poor

soils, in which cropping to tobacco alternates with a period of fallow, the yield is being maintained, though at a relatively low level. Under these circumstances the level of yields has been considerably raised by the use of commercial fertilizers.

Imports of tobacco are considerable and have increased decidedly in recent years, though in the aggregate they amount to hardly more than 10 per cent of exports. Net exports of tobacco, though large and increasing, have not kept up with the increase in production. Domestic consumption of tobacco has been increasing steadily for many years, both in total and on a per capita basis.

In response to conditions created by the World War, production increased sharply, culminating in a crop of over 1,500,000,000 lbs. in 1920; subsequent conditions led to a recession in 1921 to the pre-war level of 1,000,000,000 lbs. The average farm price for the 1921 crop was about 89 per cent above pre-war figures.

Changes in popularity of the different forms in which tobacco is consumed have necessarily affected the relative demand for the different types of leaf. A very large increase has taken place in the production of bright flue cured, together with an upward trend in price, a moderate increase in the demand for Burley, no notable permanent increase in production of dark types in recent years, and but little increase in the production of cigar leaf.

The genetics of wheat: Studies of the progeny of a speltoid mutation appearing in winter wheat, E. LINDHARD (*Hereditas, 3 (1922), No. 1, pp. 1–90, figs. 10*).—The offspring of a speltoid heterozygote (E. S. R., 43, p. 534) arising in a pedigree-line of Squarehead winter wheat segregated into plants of the normal parental type and speltoid heterozygotes. The mode of segregation and the genetic constitution of the hybrid were studied through seven succeeding generations, involving the examination of 100,000 plants. All types in the progeny seeming to differ from the original heterozygote were grown and the F_2 results of reciprocal crosses were recorded and are discussed in considerable detail.

The types, each of which appeared awned and awnless, included the normal type, speltoid homozygote and heterozygote, typical and short compactum-like heterozygotes and Squarehead heterozygotes, dwarf "common wheat" and late "common wheat," both heterozygotes and developing about four weeks later than normal, and a very late perenne type which rarely produced spikes. Besides the differences in shape and size, marked differences in fertility and in manner of segregation were found even within the same type. Several hypotheses are offered to account for the occurrence of the speltoid heterozygote.

The club wheats, J. A. CLARK and J. H. MARTIN (*U. S. Dept. Agr., Farmers' Bul. 1303 (1923), pp. 18, figs. 12*).—The club wheats are grown almost exclusively west of the Rocky Mountains with Washington, California, Oregon, and Idaho leading in their production. About 1,000,000 acres are grown annually in the United States, or less than 2 per cent of the total wheat acreage.

Hybrid 128, the leader of the 14 varieties described in this publication, is a very productive white-kerneled winter wheat and is best adapted to the subhumid sections of eastern Washington, Oregon, and Idaho. Other outstanding sorts are Jenkin, Hybrid 123, Coppei, and Hybrid 143.

Banat wheat, M. NIKOLIĆ (*Poljoprivredni Glasnik-Novisad; abs. in Ztschr. Pflanzenzücht., 9 (1923), No. 1, p. 71*).—Typical Banat wheat has an early winter-resistant plant; strong reddish-yellow stem; slender lax reddish-brown spike, up to 15 cm. in length, and with the middle spikelets inclosing three

kernels and the upper spikelets two kernels; and reddish-brown, glassy kernels, high in gluten and often with a bluish-green wax-like coating. Others than this basic form are considered as local modifications, which may be arranged into red, white, and brown groups. The red type is coarse, vigorous in growth, and late, and has large spikes. The brown is similar to the red but is rare. The white group is less hardy than the red.

HORTICULTURE.

[Horticultural investigations at the Illinois Station] (*Illinois Sta. Rpt. 1922, pp. 22, 23*).—Brief mention is made of progress accomplished in the various lines of activity (E. S. R., 47, p. 830).

In the soil treatment experiments in peach orchards at Olney, cultivation throughout the season accompanied with applications of lime, nitrate of soda, and sulphate of potash proved to be the most desirable treatment. Cowpeas were valuable as a source of humus and in preventing erosion. Forcing studies with Witloof chicory demonstrated the fact that medium-sized roots were better for forcing than very large or very small roots. Freezing the roots induced decay, but storage at 31° F. kept them in excellent condition. It was found that soil may be used continuously for greenhouse carnation culture providing a rational system of fertilization is employed. Carnation cuttings from high-producing plants excelled in both quality and quantity of bloom.

[Horticultural investigations at the New Hampshire Station] (*New Hampshire Sta. Bul. 208 (1923), pp. 8, 9, 20–22, 25–28*).—A brief review of activities for the year ended June 30, 1922 (E. S. R., 47, p. 436).

Records taken in the spring of 1922 upon the blooming performance of apple spurs whose 1921 history was known showed 10.4 per cent of blooming spurs among those nonproductive in 1921 and borne on nonbearing sod-grown trees, 0 per cent among those productive in 1921 and borne on sod-grown bearing trees, 0.5 per cent among those productive in 1921 and borne on bearing trees located in the high nitrate plats, and 40 per cent among those unproductive in 1921 and borne on bearing trees in the high nitrate plats.

Varietal tests with fruits showed Herbert to be the best of the red raspberries. The Chautauqua and Cortland apples, originated at the New York State Station, showed sufficient merit to be included in the regular test orchards. The Rochester peach and Latham red raspberry are also to be added to the list of fruits under test.

Yield records taken on Bountiful bush beans grown in 1922 on the maintenance of fertility plats showed much the largest yield of green pods on that plat which had received 32 tons of manure per acre per year. This plat yielded a net return per acre of $119.76 above the cost of the fertilizer, as compared with a value of $37.68 per acre for the check area. Portions of the plats fertilized with limestone in 1918, 1920, and 1922 at the rate of 1 ton per acre failed to show any appreciable differences in yield as compared with the unlimed areas.

In a pruning experiment with young trees, trunk diameter measurements showed larger gains in trees pruned according to the vase form and semi-leader type than in those left unpruned or trained to a full leader.

Selection studies with the Bonny Best tomato begun in 1921 indicated appreciable differences in the yield of individual strains and of individual plants. Studies of the effect of phosphorus upon the yield and time of maturity of tomatoes (E. S. R., 49, p. 234) are again noted in detail.

[Horticultural investigations at the Ohio Station] (*Ohio Sta. Bul. 362 (1922), pp. XXIV, XXVI, XXVII*).—This is a brief report of progress attained during the year.

Data presented on the comparative costs of sod mulch and tillage in two experimental orchards established in 1912 are inconclusive and contradictory, sod mulch being more profitable than tillage in one orchard and less profitable in the other. Tabulated data on fertility studies at the Marietta Truck Station show greatly increased yields of sweet corn, cucumbers, cabbage, and tomatoes following the application of chemical and animal manures. Shed manure supplemented with 400 lbs. of acid phosphate gave very good results, excelling other fertilizer combinations in the case of cucumbers and tomatoes, while the largest yields of sweet corn and cabbage were produced on the complete fertilizer plats. The results of mulching experiments with tomatoes, sweet corn, cabbage, and beans indicated that a mulch of grass or litter may result in yields equal to those obtained by thorough cultivation. The use of mulch in orchards has given good results. One orchard of Grimes Golden, Jonathan, Delicious, and Collins, planted in 1900, produced without any fertilizer average yields from 1910 to 1919 of 2.9 bu. per tree with sod, 5.6 bu. with grass mulch, and 5.4 bu. with cultivation. The cost of maintenance in a 7-year-old Stayman and Delicious orchard partly in cultivation and partly in mulch was $3.25 per tree in the tillage block and $1.38 in the mulched block.

Pruning studies in which blocks of Grimes Golden and Gano trees were pruned at different periods and in different amounts showed the maximum yield of fruit on those trees receiving only a light winter pruning. The minimum yield was obtained from trees pruned severely in both summer and winter. The highest percentage of first quality fruit was produced on severely pruned trees.

Rocky Mountain head lettuce, A. F. Vass (*Wyoming Sta. Circ. 19 (1923), pp. 11, figs. 2*).—In connection with suggestions relating to soils, varieties, planting, care of the crop, harvesting, marketing, costs and returns per acre, etc., letttuce production is briefly discussed, with emphasis on the high quality and the desirable prices received for lettuce grown in the Rocky Mountain region.

Thermal belts from the horticultural viewpoint, W. N. Hutt (*U. S. Mo. Weather Rev. Sup. 19 (1923), pp. 99–106*).—The observation of wide variations in the productivity of orchards or parts of a single orchard located on very uniform soils led to a series of experiments throughout the fruit belt of western North Carolina to determine the relation of temperature to these yield phenomena. In cooperation with the Weather Bureau, self-recording thermometers were placed at various positions in each of the orchards. In several instances the instruments located spots or frost pockets in which habitually low temperatures occurred. Often these dangerous areas were in natural depressions and at times on the high tops of ridges. Areas surrounded by forest growth were particularly subject to frost injury on account of the lack of air movement. Altitudes above 3,000 ft. were found to be above the limit of commercial apple production. Certain varieties, namely, Ingram, Mother, Virginia Beauty, Stark, and Gragg, observed to be late bloomers, oftentimes escaped the early frosts.

In conclusion, it is pointed out that these thermal belts are not fixed and definite areas, but are determined by the kind of weather obtaining. On quiet nights blooming orchards located on a slope well above the frosty bottoms, yet at an altitude below the realm of high top freezes, may remain uninjured while orchards on less favorable sites suffer severe damage.

Effect of climatic conditions on the blooming and ripening dates of fruit trees, H. A. PHILLIPS (*New York Cornell Sta. Mem. 59 (1922), pp. 1383–1416, figs. 9*).—A careful analysis of phenological data assembled by the U. S. Department of Agriculture in cooperation with numerous observers throughout the country leads to the general conclusion that, while many factors, such as available food, abundant water, pruning, spraying, and tillage, may contribute to successful fruit production, none is of greater importance than climate. Altitude was found to exert a considerable influence on the epochs in plant activity, computations showing an average retardation of one day for every 101 ft. of elevation. In respect to latitude there was found an average rate of retardation in the blooming period throughout the country as a whole of 4.6 days for each degree north. The maximum retardation occurred in the Atlantic States and the minimum along the Pacific coast, where equable weather conditions prevent rapid fluctuations in temperature. Based on the same varieties of fruits, the line of full bloom dates was found to travel across the country in a northeasterly direction. The general average range of full bloom dates at any given place was found to be approximately three weeks. Ripening dates tended to travel northward more rapidly than blooming. The number of days required for the development of a given variety of fruit is greater in the Pacific States than in the Atlantic and Mississippi States, and on account of the greater insolation in midsummer less time is required to ripen some fruits in the northern part of the Atlantic and Mississippi areas than in the southern portion.

The peach was apparently more uniform in its development than the apple, plum, cherry, or pear. It is believed that the length of day has no material influence on retarding blooms in the species of fruit studied. The data upon which the discussion is based are presented in tabular form.

New or noteworthy fruits, VI, U. P. HEDRICK (*New York State Sta. Bul. 497 (1923), pp. 3–19, pls. 8*).—This, the sixth of a series (E. S. R., 37, p. 343) relating to fruits which have shown promise on the station grounds of being useful for culture in New York, discusses and describes the Cortland, Tioga, Red Spy, and Golden Delicious apples; the Cayuga pear; the Wilma peach; the Chase cherry; the Hunter nectarine; the Brocton, Dunkirk, Ontario, Portland, Ripley, Sheridan, and Urbana grapes; the Cayuga, Owasco, and Seneca raspberries; and the Beacon, Bliss, and Boquet strawberries. The Cortland apple, Hunter nectarine, and Portland grape are illustrated in colors.

Directions for spraying fruits in Illinois (*Illinois Sta. Circ. 266 (1923), pp. 16, figs. 2*).—Spraying programs are given for the various fruits grown in Illinois and directions presented for the preparation of the more important sprays.

Spraying experiments in southeastern Ohio, 1922, F. H. BALLOU and I. P. LEWIS (*Ohio Sta. Mo. Bul., 8 (1923), No. 3–4, pp. 42–50, figs. 6*).—Experiments conducted in 1922 in a 30-year old Rome Beauty orchard at Carpenter indicated that timely and thorough spraying will give satisfactory results notwithstanding the previous history of the orchard. Not a single scab-free apple was obtained from the check trees, while a maximum of 71.9 per cent of clean fruits was produced by trees sprayed throughout the season with lime sulphur. The omission of the spray due to be applied two weeks after the open calyx treatment resulted in a secondary infection of scab and an almost negative production of clean fruit. Bordeaux mixtures of various strengths gave practically equally effective scab control. However, with the exception of the 1–3–50 strength, the Bordeaux mixtures caused more or less foliage injury. On the other hand, no injury whatever resulted from the use of lime sulphur.

Apple blotch control tests, conducted in 1922 on 20-year-old Ben Davis trees at Layman, showed little difference in the comparative effectiveness of various

strengths of Bordeaux mixture. The best control, 98.59 per cent, was secured on trees sprayed throughout the season with a 2–6–50 mixture. A 4–2½–50 mixture gave 94.19 per cent of clean apples. Lime sulphur gave fairly satisfactory control, the trees sprayed with this material yielding 85.97 per cent of blotch-free fruits, and, furthermore, the lime sulphur trees yielded much smoother and more attractive apples than were obtained from the Bordeaux sprayed trees, the copper apparently greatly aggravating injuries caused by severe frosts at the time of fruit setting.

Growth and yield of apple trees pruned in various ways, G. H. Howe (*New York State Sta. Bul. 500 (1923), pp. 3–22 pls. 6*).—This is an initial report upon a long-time pruning investigation, begun in the spring of 1912, with trees of nine important apple varieties planted the previous autumn when 1 year old. The general project is divided into three distinct divisions, which are discussed separately in the text.

I. *Little v. much pruning.*—In this project the little pruned trees received no treatment except the shaping of the head and the removing of conflicting and undesirable branches, while the much pruned trees were severely treated. The little pruned trees developed larger and broader heads, commenced bearing earlier, and showed a marked tendency to produce more fruit than those severely pruned. Measurements of trunk diameters taken in 1912, 1919, and 1921 showed no positive differences favoring either type of pruning. No differences in size, shape, color, time of maturity, or quality of fruit were observed.

II. *Winter v. summer pruning.*—Summer pruning failed to affect the growth or fruit bearing habits of the trees in any way different from winter pruning. Bearing commenced concurrently with that of winter pruned trees, and differences in the amount of fruit borne by the contrasting groups were insignificant. Summer pruning was done with difficulty after the trees had begun to bear.

III. *High v. low heads.*—High-headed trees, branching approximately 4 ft. above the ground were compared with low-headed trees, with branches about 20 in. from the ground. The most important differences found in the two groups were those of size and vigor, the high-headed trees being inferior in both respects. Measurements of the trunk diameters of the two groups showed those of the high-headed trees to be considerably the smaller. The bearing area of the high-headed trees was considerably reduced, and, therefore, these trees bore much the smaller crops. Height did not apparently have any effect upon the quality of the fruit. The high trees were subject to wind injury, which in certain instances caused twisting of the trunks. In respect to pruning, spraying, and harvesting, the low-headed trees were more desirable, and no difficulty was found in working the soil beneath the limbs. The severity of the pruning treatment required in forming high-headed trees may very easily impair the vigor of the tree and check its normal development.

Apple pollination, J. M. Keil (*Ohio Sta. Mo. Bul. 8 (1923), No. 3–4, pp. 51–58, fig. 1*).—Tests conducted in the station orchards over a period of several years indicated that cross-pollination is more satisfactory than self-pollination in the apple. In general, selfing resulted in little or no fruit. In self-pollination studies no notable differences were found whether pollen was taken from the same flower, the same cluster, another cluster, or from a separate tree. Cross-compatability studies indicated that practically all concurrently blooming varieties are able to serve as pollinizers for one another. The Stayman, as noted earlier by Auchter (E. S. R., 47, p. 743), proved a notable exception to the general rule, yielding only 3.1 per cent of fruits in a total of 128 crosses in which the variety was used as pollen parent. The data for the various pollinations are presented in detailed tabular form.

The pear in New York, H. B. Tukey (*New York State Sta. Bul. 495 (1922), pp. 3–19, fig. 1*).—Following a brief introductory statement dealing with history and botany, information of a general nature is presented relative to different phases of pear culture, namely, selection of site, choice of nursery stocks, planting, pruning, cultivation, fertilization, pollination, and the control of fungus and insect pests. Brief descriptions are given of the 21 leading varieties. The information is for the most part summarized from that contained in the recently noted Pears of New York (E. S. R., 48, p. 537).

Peach growing in Ohio, J. H. Gourley (*Ohio Sta. Mo. Bul. 8 (1923), No. 3–4, pp. 35–42, fig. 1*).—General information is presented relative to the culture of the peach, including planting, pruning, spraying, fertilization, choice of varieties, etc.

Stocks for plums, U. P. Hedrick (*New York State Sta. Bul. 498 (1923), pp. 3–19, pls. 6*).—Yield and vigor records taken during the first 10 years' existence of an experimental plum orchard in which trees of 15 leading varieties, European, American, and Japanese were worked on six different stocks, namely, Americana, Marianna, Myrobalan, St. Julien, peach budded, and peach grafted, gave evidence that Myrobalan is the best general purpose plum stock. Average yields for the period 1916–1922 show that Bradshaw, Reine Claude, Lombard, Chabot, Burbank, Forest Garden, and Drap d'Or were most productive on Myrobalan stocks; Italian Prune, Shropshire, Pottawattamie, and Abundance on budded peach; Grand Duke, Wild Goose, and Wayland on Marianna; and De Soto on Americana.

As indicated by gain in diameter of trunk during the period of 1912–1921, trees on Myrobalan had a distinct advantage, making the largest gains in 11 of the 15 varieties, tieing in 3 cases, and losing in only 1 instance, that of Wild Goose on Marianna. Despite the rather poor showing of St. Julien, this stock is deemed to be the second best for general purposes, especially for Domestica and Insititia varieties. Based on field observations, the trees on St. Julien made a very satisfactory growth. It is suggested that Wild Goose, Pottawattamie, Forest Garden, and Wayland may be best grown on Marianna. The peach proved very satisfactory, but is considered too tender to be classed as a general purpose stock. It is pointed out that the results of the experiments are in accord with commercial practices, in that Myrobalan is the commonest plum stock in use in New York orchards and nurseries. The various stocks used in the experiment are described in considerable detail.

Plum stocks, J. D. Luckett (*New York State Sta. Bul. 498, pop. ed. (1923), pp. 4, pl. 1*).—This is a popular edition of the above-noted bulletin.

Some new hybrid strawberries, R. F. Howard and C. C. Wiggans (*Nebraska Sta. Bul. 189 (1923), pp. 15, figs. 3*).—Strawberry breeding in the greenhouse and field in the winter and spring of 1913 resulted in the production of 762 seedlings, which by processes of rigorous selection were reduced in the spring of 1922 to 10 hybrids. These were deemed so promising as to be distributed for test in various points of Nebraska and other States. Data are presented upon the yield, ripening period, and keeping quality of these seedlings as compared with established varieties.

The ability of various varieties to transmit superior qualities to their progenies was noticed particularly in the instance of Dunlap, which occurs as pollen parent in 4 of the 10 selections. Over a period of 4 years the 10 hybrids yielded an average of 266.8 crates per acre, as compared with 252.6 crates for the 10 highest commercial kinds. In respect to maintenance of size throughout the harvest period, the seedlings were markedly superior to Warfield or Dunlap varieties, designated as standards for the Middle West.

The avocado in Porto Rico, J. P. GRIFFITH (*Porto Rico Dept. Agr. and Labor Sta. Circ. 72 (1923), pp. 3–41, figs. 13*).—Of three types of avocado, namely, the West Indian, Guatemalan, and Mexican, now found in Porto Rico, the West Indian is indigenous and is found scattered throughout the islands, usually in fence rows and yards, and very rarely in orchard form. The Guatemalan and Mexican types, both of comparatively recent introduction, contain varieties very much superior in quality to the natives, but not so well adapted to the environment. In many instances these introduced varieties have been top-worked successfully on the vigorous native stocks, but it is believed that the ultimate avocado variety for Porto Rico will be hybrid in character, the native crossed with the Guatemalan. Directions are given for propagation, grafting, care in the field and nursery, use of cover crops and fertilizers, pruning, harvesting, marketing, and for combating insect and fungus enemies.

FORESTRY.

Our vanishing forests, A. N. PACK (*New York: Macmillan Co., 1923 pp. XVI+189, figs. 51*).—This book points out the vital necessity to the Nation of an abundant wood supply, recounts the astounding number of uses to which wood is put, and urges the citizens of the country to awaken to the seriousness of the declining supply.

Timber: Mine or crop? W. B. GREELEY ET AL. (*U. S. Dept. Agr. Yearbook 1922, pp. 83–180, figs. 22*).—A comprehensive article of general nature dealing with the forestry problems of the United States. Emphasis is placed upon the rapidly declining supply of high-grade timber, the increasing distance from markets, the advisability of classifying land according to its adaptability for agriculture or forestry, and the need of regulating cutting and of increasing production to full capacity. The intimate relation between rural prosperity and productive forests is pointed out, and examples are cited to show that the depletion of the timber supply may mean ruin to any community dependent on woodworking industries. The necessity of controlling fire, combating insect and fungus pests, and reducing taxes on immature forests is stressed. Progress in research and education and in reforestation is reviewed. In conclusion, three outstanding measures for promoting forestry in the United States are set forth, (1) the control of unrestricted exploitation, (2) the elimination of unnecessary wastes, and (3) the stimulating of production to the full capacity of the land.

First report on a forestry survey of Illinois, R. B. MILLER (*Ill. Nat. Hist. Survey Bul. 14 (1923), Art. 8, pp. [3]+291–377, pls. 29, figs. 9*).—This is a detailed report concerning the forestry resources of that part of Illinois embracing all of Jackson and portions of Union, Alexander, Pulaski, and Randolph Counties.

Indiana woodlands and their management, C. C. DEAM (*Ind. Dept. Conserv. Pub. 28 (1922), pp. 20, pls. 3*).—Subsequent to a brief discussion of land classification, information of a general nature is given relative to desirable species for forest planting, the growing of seedlings, cultural requirements, and the necessity of protection from cattle, fires, etc.

[Forestry investigations at the New Hampshire Station] (*New Hampshire Sta. Bul. 208 (1923), p. 20*).—Measurements recorded in sample plats in mixed stands of hardwood and white pine yielded conclusive evidence that the white pine does not grow as rapidly in the initial 10 years of its life as do black birch, red maple, red oak, paper birch, and other hardwoods. It is recommended, therefore, that white pine be freed from competition in order to insure its survival.

[**Forestry investigations at the Ohio Station**] (*Ohio Sta. Bul. 362 (1922), pp. XXXV–XXXVII, XL*).—Substantial progress is recorded for the year. An efficient fire-fighting organization was developed in the southern part of the State to protect the extensive timber areas. A total of 8,441 acres was added to the State forests and 20,300 trees planted. In addition, over 200,000 trees of 23 species were distributed to private owners. A detailed survey of 10 counties completed during the year showed that the original timber stands are deteriorating in quality from attacks of fire, erosion in abandoned fields, and from the growth of undesirable species.

Report of the forestry commission for the year ended June 30, 1922, R. Dalrymple-Hay (*N. S. Wales Forestry Comn. Rpt., 1922, pp. 16*).—This report, presenting the customary data (E. S. R., 46, p. 843) relative to silvicultural activities, forest fires, fiscal affairs, etc., emphasizes the necessity of an adequate afforestation program in order to provide soft woods for the future.

The Bandelier National Monument, Santa Fe National Forest, N. Mex. (*U. S. Dept. Agr., Misc. Circ. 5 (1923), pp. 18, figs. 14*).—A profusely illustrated circular calling attention to the attractive and interesting features of this unique park, in which are located ruins of the ancient cliff dwellers.

Growth of shortleaf pine (Pinus echinata) planted in District of Columbia and New Jersey, W. R. Mattoon (*Jour. Forestry, 21 (1923), No. 3, pp. 284, 285*).—That the shortleaf pine is a rapid grower was shown in observations taken on trees planted in the District of Columbia in 1913. These trees, averaging 14.1 ft. in height and 3.3 in. in diameter at breast height in November, 1921, were excelled in height growth only by the European larch. The tree is deemed very promising for planting in the Piedmont region and in sections of eastern Kentucky and Tennessee and the hilly areas of Arkansas, Oklahoma, and Texas. Emphasis is placed upon the necessity of planting well-grown seedlings, in that 7-year-old forest grown trees planted at the same time as 2-year-old open field stock perished after an unthrifty existence of three or four years. A planting of similar poor material in New Jersey also resulted in a complete failure.

A note on the several species of Araucaria cultivated in South Africa, J. J. Kotzé (*Union So. Africa, Forest Dept. Bul. 6 (1923), pp. 37, figs. 18*).—Descriptive notes are presented on several species of Araucaria, as grown in their native habitats and as introduced plants growing in South Africa.

Hevea selection, G. Bryce and C. H. Gadd (*Trop. Agr. [Ceylon], 60 (1923), No. 2, pp. 94–96, pls. 2*).—Records taken upon the latex yield of 161 9-year-old Hevea trees, all descendants from a single high-yielding mother tree, indicated that none of the young trees was equal to the parent in productivity. The authors believe that this reduction in yielding capacity is probably largely due to the fact that the mother tree was openly pollinated, thereby introducing poor qualities of unknown pollen parents.

The West African oil palm and its products, G. G. Auchinleck (*Ceylon Dept. Agr. Bul. 62 (1923), pp. 18, pls. 5*).—This is a presentation of general information regarding the oil palm.

The international forestry bibliography, including allied subjects, A. H. Unwin (*Critchmere, Haslemere, Eng.: Forest Lover's Libr., 1921, pp. 48*).—This is a list of books and publications relating to forestry matters in various parts of the world.

DISEASES OF PLANTS.

[Investigations on crop diseases in Illinois] (*Illinois Sta. Rpt. 1922, pp. 14, 15*).—It is reported that the condition of corn seed as regards disease is closely correlated with the proportion of weak seedlings produced. Abnormally early planting may, in case of diseased seed, lower vigor through exposure to cold and hence the resistance to rots, while healthy seed produces a high percentage of strong seedlings capable of enduring early spring conditions with little harmful effect. The ear conditions that prove most significant as indicating diseased conditions and low yielding ability are, in order of importance, shredded shanks (exposed butts of cobs), starchy kernel composition, pink shanks, and black bundles (black deposits in the vascular bundles visible on the ear shank). Soil infestation with corn root, stalk, and ear rot organisms is deemed an important factor causing low yields in fields cropped to corn two or more successive seasons.

As regards wheat varieties resistant to flag smut, only 9 out of 200 appeared wholly so, and none of these appeared to be adapted, if adaptable, to the conditions of the region infested. Apparently early seeding favors and late seeding reduces smut infection (see also the bulletin by Tisdale et al. noted below).

Diseases of grain and forage crops in North Dakota, W. Weniger (*North Dakota Sta. Bul. 166 (1923), pp. 92, figs. 32*).—The three main portions of this bulletin deal, respectively, with diseases in nine North Dakota cereal crops (importance, causes, symptoms, and descriptive accounts), diseases of three general classes of forage crops (legumes, grasses, and sunflower), and methods of disease control (exclusion, eradication, protection, and resistance).

Flag smut of wheat, with special reference to varietal resistance, W. H. Tisdale, G. H. Dungan, and C. E. Leighty (*Illinois Sta. Bul. 242 (1923), pp. 507–538, figs. 3*).—Wheat flag smut, said to be confined as yet in the United States to a limited area in southwest Illinois, with four farms adjacent in St. Louis County, Mo., and to cause there losses ranging in some cases as high as 10 to 20 per cent, has been studied as to life history and control measures of the causal organism (*Urocystis tritici*). It is spread by spores, chiefly those adhering to the seed grains or else remaining viable in the soil after being scattered by the usual agencies. Some spores overwinter in the soil near Granite City, Ill. Though these may not, so far as yet known, affect the subsequent fall sowing, spores from the summer crop are known to do so. Rotation is a practical and may prove to be a necessary measure. Control was secured where smutted seed were treated with copper sulphate and lime or with copper carbonate, but not where smutted seed were sown in furrows previously dusted with smut spores. Three-year trials showed that wheat sown after November 1 or in early spring is less subject to flag smut than that sown in early fall. This is probably due to the cool temperature, which lowers spore germination.

Of about 200 wheat varieties tested, 41 were highly resistant and 14 immune. Several of the desirable strains are to be further tested for wider sowing. Immune locally adapted varieties include Beechwood, Fulcaster (Marvelous and Stoner), Imperial Amber, Red May (Early Harvest), Red Rock, and Shepherd. The more susceptible varieties commonly grown in the infested area include Flint (May), Gipsy (Niagara), Red Wave, Jones Fife, and Fultz, the most susceptible being Harvest Queen (Red Cross or Salzer Prizetaker).

Investigations of the rosette disease of wheat and its control, H. H. McKinney (*Jour. Agr. Research [U. S.], 23 (1923), No. 10, pp. 771–800, pls. 8,*

figs. 2).—It is the purpose of this paper to present the results obtained during three years in investigations on the rosette disease of winter wheat. This disease, reported from Madison County, Ill., in the spring of 1919 by G. R. Lyman,[1] later found in other counties in Illinois and several counties in Indiana, and shortly after its discovery described by Humphrey and Johnson (E. S. R., 41, p. 746), apparently was considered identical with the take-all disease occurring in Australasia and the foot rot disease occurring in Europe. However, investigations herein reported show that the rosette disease of wheat differs from take-all in plant symptoms and also in the varietal and host ranges. Furthermore, it is claimed, none of the fungi which are commonly found in association with take-all abroad and in parts of this country have been found associated with the rosette disease. It is considered evident that the latter disease occurring in Illinois and Indiana is distinctly different from the take-all disease.

The disease symptoms are described. The first positive indication of the disease as now interpreted consists in a retarding of the early spring development of the fall tillers. At this time no external lesions are consistently associated with the living tissues of the diseased plants.

Rosette has recurred in the field each year since it was reported, but the typical plant symptoms have not been reproduced satisfactorily under ordinary greenhouse conditions or in the field outside the regular season for winter wheat, thus reducing the problem to a seasonal one until such time as special methods shall have been perfected.

The origin of the disease is unknown, but it is believed to have been present in certain areas for some time. So far as definitely known, the disease occurs only in certain varieties of winter wheat. The most constant or characteristic symptoms consist of arrested spring development, excessive tillering which results in a rosette appearance, and a dark blue-green color of foliage. A black mycelial plate, rather characteristic of the take-all and foot rot type of malady, has never been found associated with rosette. It is diagnosed with the greatest certainty in the spring before healthy plants reach the boot stage. It behaves somewhat like Fiji, sereh, and mosaic diseases of sugar cane and corn mosaic.

Winter injury and low temperature are not the prime causes for rosette, and it is probably not caused by nonparasitic soil factors. The results from soil disinfection indicate an organism or a virus as the causal factor. Certain unusual intracellular bodies have been found in association with wheat plants showing the very early stages of rosette. Several fungi have also been found associated with diseased plants during certain stages, but none consistently associated with the trouble in early spring. The disease is carried in the soil, possibly also by the seed. The causal agent is known to persist in summer-fallowed soil for at least two years without apparent loss of virulence.

Soil disinfection experiments in the field show that a solution of 40 per cent formaldehyde and water (1 to 49) will control the disease, as will also steam sterilization. Resistant varieties also afford a means of control, as only 6 per cent of the 150 varieties and selections used experimentally have shown definite susceptibility. Extremely late fall seeding with spring emergence of seedlings would control the disease, but this method is not practicable.

Symptoms of wheat rosette compared with those produced by certain insects, H. H. McKinney and W. H. Larrimer (*U. S. Dept. Agr. Bul. 1137 (1923)*,

[1] "Take-all" of Wheat in This Country. U. S. Dept. Agr., Bur. Plant Indus., Plant Disease Survey [Circ.], May 1, 1919, p. 1.

pp. 8, pls. 4).—A complete description of the symptoms of wheat rosette has been given by McKinney in the article noted above.

The present authors have made observations and conducted experiments with wheat rosette and also with a number of wheat diseases caused by insects which in certain stages of development might be confused with wheat rosette.

While all evidence indicates that the disease in question is not caused by an insect, particularly the Hessian fly, it is recognized that under certain conditions there is a possibility of confusing the symptoms of the disease with certain of those produced by the Hessian fly, the wheat strawworm (*Harmolita grandis*), and to a less extent the wheat stem maggot (*Meromyza americana*). For this reason the authors give the chief points of similarity and difference between the symptoms of the two classes of injuries.

It is concluded that the symptoms of rosette can not be distinguished with certainty after the spring period, and it is safer not to diagnose the disease positively after early spring, especially after heavy rains have washed out many diseased plants.

Influence of soil temperature and moisture on the development of the seedling blight of wheat and corn caused by Gibberella saubinetii, J. G. Dickson (*Jour. Agr. Research* [*U. S.*], *23* (*1923*), *No. 11, pp. 837–870, pls. 6, figs. 15*).—The seedling blight of wheat caused by *G. saubinetii* is manifest first by blighting before emergence, which results in poor germination; second by blighting after emergence, which is evident by the yellowed and wilted seedlings; and third by stunting the seedling, which is due to the weakened root system.

The symptoms of corn seedling blight due to the same organism are in general similar to those of wheat. The disease develops from infected seed, scabbed seed in the case of wheat, and infested soils. The period of seedling infection in both wheat and corn is usually limited to the early seedling stage. Under favorable environmental conditions, the extent of blighting and injury from seedling blight is directly proportional to the amount of infestation. The parasite in pure culture functions normally from 3 to 32° C., the optimum temperature for spore germination, vegetative development, and sporulation being about 24° (75.2° F.) on unacidified and 28° on acidified media.

Soil temperature is the most important single factor determining the extent of seedling blight. The most favorable temperature for the blighting of wheat ranges from 12 to 28°; that of corn from 8 to 20°. Low soil moistures favor blighting of wheat even at low temperatures. Results from field tests with wheat and corn agree with those from the greenhouse.

Infection takes place and the blight progresses at entirely different temperatures with the two different hosts. The influence of environmental factors on the hosts seems to be the fundamental cause of susceptibility to the disease. Seedlings become susceptible when they are unable to respond favorably to the environment.

Bean anthracnose (*New Hampshire Sta. Bul. 208* (*1923*), *pp. 24, 25*).—Experiments were made by W. L. Doran on the control of bean anthracnose by heating diseased seed for two hours at 80° C. (176° F.), by dusting and spraying with Bordeaux mixture, and by covering the plants during the rainy weather until the cotyledons had fallen. Spraying with Bordeaux mixture gave better results than dusting, and covering the plants gave a very satisfactory degree of control. Heating diseased seed gave less protection.

Gray mold of castor bean, G. H. Godfrey (*Jour. Agr. Research* [*U. S.*], *23* (*1923*), *No. 9, pp. 679–716, pls. 13, figs. 5*).—The author presents a somewhat detailed account of studies on the castor bean gray mold previously described

as due to *Sclerotinia ricini* (E. S. R., 43, p. 849). This disease appears to have been introduced from India on seed which were distributed widely and planted extensively in 1918. The disease developed remarkably during the year, being found in Florida, Mississippi, Louisiana, and Texas, but not in South Carolina, Alabama, Georgia, Tennessee, or Arkansas. Losses of from 10 to 100 per cent developed in the districts affected.

A succession of several continuously wet days led to the development and spread of the disease, the percentage of loss being high in localities having much of this kind of weather.

The disease is a typical Botrytis blight, the inflorescences or spikes being attacked in all stages of development with heavy growth of mold, causing their complete destruction, and the leaves and stems being also occasionally attacked. During the winter and spring following, sclerotia appeared in abundance, at first on old spikes and later on the stalks.

Histological studies showed that penetration of the cuticle, apparently by mechanical means, was necessary before injury was done. The fungus appears to be practically limited to the castor bean. Some difference in varietal susceptibility was noted, the coarse ornamentals being in general more resistant than the commercial seed-producing sorts. Nothing promising in the way of control by this means was evident. Extensive experiments indicated that control through fungicides is entirely impracticable after the disease has become established. Castor bean seed are not readily injured by reasonable chemical treatment. Control of this disease in the event of any future heavy planting should consist primarily in prevention.

The prevention of corn root rot (*Ohio Sta. Bul. 362 (1922), pp. XXIV, XXV*).—Investigation during three years to ascertain the predominating cause in Ohio of corn root rot has shown such cause to be *Diplodia zeae*, more generally known as causing corn dry rot or mold. The disease is present generally throughout the State, being more serious in the west and southwest. Comparisons made show a marked reduction of crop where rag doll tests indicate diseased seed grains. Such tests in expert hands can be used to increase yield markedly, though it is admitted that the average inexpert corn grower may not profit greatly by such tests.

Downy mildew on lettuce in California, D. G. Milbrath (*Jour. Agr. Research [U. S.], 23 (1923), No. 12, pp. 989–994, pls. 3*).—In conclusion of an account dealing with the early classification of the fungus of lettuce downy mildew, its distribution in California, the symptoms, destructiveness, causal fungus, and susceptibility of varieties, it is stated that in California climatic conditions are favorable to the growth of *Bremia lactucae* on lettuce in the field. The abundance of the fungus has given rise to an important problem in transportation as well as in the field. The solution of the field problem has been brought in sight by the determination of the existence of resistance in certain varieties of lettuce, notably Iceberg.

The diseases of pepper, B. B. Higgins (*Georgia Sta. Bul. 141 (1923), pp. 47–75, figs. 11*).—In this account a rather full description regarding some relatively unimportant diseases is given, as is also a discussion of some important diseases not yet reported from this section. The information as detailed relates to pepper damping-off (Rhizoctonia), Sclerotium blight (*S. rolfsii* chiefly), mosaic (virus, not known, transferred by aphids), Cercospora leaf spot (*C. capsici*), bacterial spot (more serious), blossom-end rot, sunburn anthracnose (Gloeosporium and Colletotrichum), fruit rot (*Macrosporium* sp. or *Alternaria* sp.) and Phoma rot (*P. destructiva*).

Seed sterilization tests, as tabulated with descriptive account, show that the response of pepper seed to treatment with disinfectants is very erratic, possibly

due to changes related to the age of the seed. Mercuric chlorid treatment of fresh seed stimulated germination, while such treatment of seed six months older impaired germination. Copper sulphate stimulated germination in all cases, though seedlings from seed treated with copper sulphate alone showed some injury, root development being poor. Copper sulphate followed by lime gave improved germination and clean, well developed seedlings. Formalin without subsequent liming was the only treatment producing serious injury. Only the mercuric chlorid and the copper sulphate treatments are recommended for general use.

Damping-off of pepper seedlings can be prevented, not by mixing either lime or sulphur with the seed-bed soil, but by keeping the soil surface loose and dry. Apparently loss due to Sclerotium blight can be reduced by applying lime to the soil.

Further studies on the pathogenicity of Corticium vagum on the potato as affected by soil temperature, B. L. Richards (*Jour. Agr. Research [U. S.], 23 (1923), No. 9, pp. 761–770, pl. 1, fig. 1*).—The temperature studies, previously reported (E. S. R., 45, p. 543), were during 1918 and 1919 extended into the field, the outcome of this field experimentation being presented in the present paper.

The results from the field experiments agree with those from the greenhouse work in emphasizing the controlling influence of soil temperature upon the pathogenic power of *C. vagum*, especially as regards the pathogenicity of the sterile stage of the fungus on potato.

C. vagum caused greater growing-point destruction and a more severe type of cortical injury on the early potato crop planted April 26 and May 7 than on the later plantings of May 17 and 30, this difference being due to a sudden rise in the soil temperature at such dates as to permit early growth of the later crops to take place in a very warm soil.

Growing tips of the young primary shoots grown from potato tubers planted at the early dates were destroyed in cold soil by *C. vagum*, while secondary primordia developed from such injured shoots later grew through warm soil uninjured.

Greater damage to potato plants occurred in the field in sclerotia-inoculated soil during the cool season of 1918 with a daily mean soil temperature for June of 20.1° C. (68.18° F.) than during 1919 with an average daily mean of 23° for the same growth period. This loss in 1918 was expressed in a greater decreased stand, a greater number and a more severe type of stem lesions, fewer stems per hill, decreased number of tubers per hill, and a total loss in yield of 50 per cent as opposed to a total loss of 15.4 per cent in 1919.

The results in general indicate that the occurrence of an average daily mean temperature of 2° above or below the critical temperature (21°) for the pathogenicity of the *C. vagum* on the growing points during the first six weeks of potato growth may accurately govern the damage done to the crop by this fungus in any one season.

Spraying potatoes (*New Hampshire Sta. Bul. 208 (1923), p. 24*).—In the potato-spraying work, experiments were conducted on the effect of pressure and number of nozzles used on the control of late blight. The potatoes were sprayed four times with 8–4–50 Bordeaux mixture applied every two weeks, but late blight did not develop in the field and no data were obtained. It was noted, however, that neither the number of nozzles used nor the amount of mixture applied per acre had any stimulatory effect on the yield of the plants.

Experiments with inoculated sulphur.—Preliminary report, F. W. Geise (*Virginia Truck Sta. Bul. 42 (1923), pp. 259–263*).—This paper presents the re-

sults of experimentation during 1922 on control of potato scab (*Actinomyces chromogenus*) by the use of inoculated sulphur, here specifically referred to as a proprietary product containing finely pulverized sulphur and inoculated with certain sulphophying bacteria. The effects were sought as regards immediate effects on potatoes and possible residual effects.

The tests in which inoculated sulphur was used showed that a partial control of the potato scab organism was effected on the early crop of Irish Cobbler potatoes. The relative amount of scab control varied in different tests. This variation may in part be attributed to varying soil conditions as they occurred in different localities. From the viewpoint of the practical grower, 300 lbs. per acre of inoculated sulphur gave better control in proportion to the amount of material used than 450 or 600 lbs. In view of the harmful residual effect on subsequent crops resulting from the use of excessive amounts of inoculated sulphur, it is believed that on the basis of data obtained with soy beans, spinach, corn, and late potatoes, only quantities not exceeding 300 lbs. per acre should be used during any one season on the same land under the soil conditions and crop-rotation systems prevailing in eastern Virginia.

Anatomical studies on potato wart, E. F. Artschwager (*Jour. Agr. Research [U. S.], 23 (1923), No. 12, pp. 963–968, pls. 5*).—The potato wart appears as a proliferation of meristematic regions of stem, stolon, and tuber. Warts are developed abundantly on all underground parts except the roots. The tumors vary in size from minute undifferentiated protuberances to intricate branch systems. The largest warts develop on the underground stalk and terminally on stolons, while the smallest appear on tubers, usually as the result of belated infections. The wart consists fundamentally of depressed, antler-shaped branches or metamorphosed leaves, partly grown together and branching profusely near the periphery.

The older basal part of the wart and more especially the transition region show a gradual approach to the normal structure. From anatomical analysis the wart is a homoplastic growth with quantitative reduction in vascular tissue and increase in storage parenchyma. In semiresistant varieties wart development remains superficial. The wart can be considered a foliar branch system. The existence of various types of warts seems to be bound up with the relative susceptibility of the host, the nature and extent of the primary infection, and such factors as tend to modify plant growth in general.

Tomato leaf spot and experiments with its control, J. H. Muncie (*Pennsylvania Sta. Bul. 177 (1922), pp. 3–23, figs. 3*).—This report is the result of three years' work at the station field laboratory at Girard, Pa., and on a farm at North Girard.

So far as is known the leaf spot disease attacks only certain varieties of the cultivated tomato and the common horse nettle (*Solanum carolinense*) under natural conditions. The disease (*Septoria lycopersici*) is prevalent throughout Pennsylvania, though it has been studied thus far only near Lake Erie. It causes serious defoliation of the plants, the leaves, stems, and blossoms being attacked. The fungus appears sporadically about July 1, spreading to practically every plant by August 15. Insects appear to be of little importance locally, but the disease is spread by spores splashed up by rain or carried upon the hands of tomato pickers. The trouble is greatly reduced by spraying with Bordeaux mixture 4–4–50, Bordeaux soaps 4–2–3–50 and, preferably, 4–4–3–50, or with copper soap 0.5–0–3–50. The use of spray mixtures did not increase the yield of ripe fruit, partly because in the locality where this work was done the season is too short to allow all the fruit to ripen on sprayed plants.

Origin of the central and ostiolar cavities in pycnidia of certain fungus parasites of fruits, B. O. Dodge (*Jour. Agr. Research [U. S.], 23 (1923), No. 9,*

pp. 743–760, pls. 6, fig. 1).—An investigation of fungi associated with rotting strawberries and dewberries during shipment and marketing has afforded an opportunity for study of the development of the pycnidial forms of several species of fungi, from which it appears that in these forms there are three principal stages or periods of growth, the first being one of rapid cell multiplication whereby a certain amount of fundamental or undifferentiated tissue is formed with which to begin the construction of the fruit body, the second or intermediate stage including those activities leading to the formation of the central cavity, the organization of the wall, the delimitation of sporogenous tissue, and, in many forms, the construction of the ostiole. Previous study has largely been confined to the third stage which includes spore production and other developments which characterize the mature pycnidium.

The intermediate stages in the development of the pycnidia of the three species of fungi associated with fruit rots have been studied, and in each case it has been shown that the initial stage in cavity formation consists in the disorganization of cells in a certain region, accompanied by a swelling of the cell remains. The pressure thus resulting tends to enlarge the cavity, maintain a symmetrical contour, and contribute further toward cell destruction or change of form. Further enlargement of the cavity may be effected by the growth of elements already present or by the addition of new tissue. In *Phyllostictina carpogena* the cavity is formed lysigenetically for the most part. In *Sclerotiopsis concava* the central cavity is about equally lysigenetic and schizogenetic. The central cavity in *Schizoparme straminea*, as it grows on strawberry, is largely schizogenetic. The first hyphae to grow into the central cavity as it forms are the homologues of sorophores, but they do not necessarily produce spores. Food for spore production is found in the parenchyma at the center of the immature fruit body in the first two forms. The pycnidium of the third species remains plastic for a long time, so that additional food may be easily obtained from the substratum upon which the fungus is growing.

The action of sulphur fungicides (*New Hampshire Sta. Bul. 208 (1923), p. 14*).—In a study of the conditions under which sulphur fungicides are toxic to parasitic fungi, W. L. Doran found that sulphids are extremely toxic, but that since the polysulphids decompose rapidly on drying their value is merely a contactual one. It was found that sulphur is more active at high than at low temperature, though toxic only when acting in the presence of oxygen.

Dry-mix sulphur lime, a substitute for self-boiled lime sulphur and summer-strength concentrated lime sulphur, A. J. Farley (*New Jersey Stas. Bul. 379 (1923), pp. 16, figs. 3*).—The author records orchard tests made with peaches and apples, concluding with a recommendation including dry-mix sulphur lime as a substitute for self-boiled lime sulphur as a summer fungicide for tree fruits. Beginning with the petal-fall application it should be used as a substitute for concentrated lime sulphur on apples, except when such diseases as blotch, bitter rot, and cedar rust are serious. It is strongly recommended as a substitute for concentrated lime sulphur for use as a summer fungicide on varieties of apples that are easily russeted.

The adhesive quality of copper acetates (*New Hampshire Sta. Bul. 208 (1923), pp. 13, 14*).—Investigation, elsewhere reported (E. S. R., 48, pp. 143, 544), into the basic action of spray materials as made by O. Butler and T. O. Smith in connection with the study of the adhesiveness of copper acetates has been continued to determine both the effect of duration of drying and the effect of an addition of gelatin. One per cent mixtures of both neutral and basic acetate of copper were sprayed on glass slides, the interval between the application of the wash and the incidence of rain being from 24 hours to 15 days. When the mixture did not contain 0.05 per cent gelatin, the data obtained

showed that the decomposition of the neutral acetate measured in terms of adhesiveness is roughly proportional to the time; in the case of the basic acetate of copper the rate of decomposition is extremely rapid during the first four days but slower thereafter. The adhesiviness of the neutral acetate never became equal to that of the basic acetate of copper. When gelatin was added to the washes, adhesiveness of the neutral acetate became at the end of 48 hours virtually the same as that of the basic acetate plus gelatin, and was only slightly lower at each of the subsequent periods of observations. The addition of the 0.05 per cent gelatin greatly increased the adhesiveness of both the basic and neutral salts, the more marked effect being produced upon the latter.

Spraying experiments (*Ohio Sta. Bul. 362 (1922), pp. XXVIII, XXIX*).—Apple-tree spraying experiments for 1922 at Carpenter, considered as representative, are briefly detailed. Lime sulphur 1–40 was used at petal fall to avoid russeting by Bordeaux mixture, which was used as a dormant, pink, postpetal-fall (two weeks after) application and again ten weeks later.

Bordeaux mixture at 3–9–50 gave 50 per cent freedom from scab and 13 per cent deformed by scab. Bordeaux at 2–6–50 gave 51.5 per cent freedom and 12 per cent deformity. Less favorable results followed Bordeaux at 2–6–50 in the pink and 1–3–50 thereafter. Lime sulphur at 1–25 in the pink and 1–40 later gave 58 per cent freedom and 5.5 per cent deformity. Lime sulphur 1–40 throughout gave 72 per cent freedom and 5.3 per cent deformity.

Apple scab (*New Hampshire Sta. Bul. 208 (1923), p. 24*).—Experiments were carried out by O. Butler and W. L. Doran in two McIntosh orchards in which apple scab had proved extremely injurious the previous year, verdigris and various types of Bordeaux mixture being used. In one orchard four applications of the fungicides were given, the pre-pink, pink, calyx, and two-weeks-after-the-calyx sprays; in the other orchard the pre-pink spray was omitted. The better control was obtained in the orchard in which the pre-pink was used.

Sclerotinia carunculoides, the cause of a serious disease of the mulberry (Morus alba), E. A. Siegler and A. E. Jenkins (*Jour. Agr. Research [U. S.], 23 (1923), No. 10, pp. 833–836, pls. 2, fig. 1*).—*S. carunculoides* n. sp. is described as causing a disease of fruits of cultivated mulberry (*M. alba*) completely spoiling them as an edible fruit. The disease is known to occur in South Carolina and has been reported from other Southern States. Ascospores of this fungus have been found on blooms which were collected not less than 8 ft. above the nearest group of apothecia. The occurrence of the microconidial form of the fungus in the diseased fruit is noted. The most striking feature which distinguishes this fungus from others of the same group is the presence of a prominent caruncle-like body on the concave surface of the ascospore.

The citrus nematode, Tylenchulus semipenetrans, E. E. Thomas (*California Sta. Tech. Paper 2 (1923), pp. 19, pls. 8*).—Investigation is reported of the citrus nematode previously made the subject of preliminary study by the author (E. S. R., 28, p. 850) and afterwards determined as *T. semipenetrans*, and further studied by Cobb (E. S. R., 31, p. 449).

Heavily infested trees showed evidences of undernourishment and injury, the leaves being small and yellowed or mottled, the fruits small, and the whole tree stunted and sickly. The greatest direct injury is done to the small feeding rootlets, which, it is stated, are pierced sometimes as much as eight or ten cells deep. So far as yet known, *T. semipenetrans* is confined to citrus plants. In badly infected trees, large percentages of the small rootlets are involved, and the portion above ground is undernourished. This was definitely determined by pot growths using nursery trees, a number of which were killed

or badly stunted. No severely infested tree examined was found in good condition. The nematodes are carried in and from the soil in the usual ways. No practical method of elimination has been found. The best results were obtained with hot water, but the safely killing temperature for nematodes and eggs lies close to the danger point for citrus trees. No satisfactory means has yet been found of removing the nematodes when once established on the roots of citrus trees.

Attack by a Fusarium appears to be favored by previous nematode attack, though healthy citrus roots are not easily injured by that fungus.

In soil treatments, no noticeable effect was produced on the nematodes by lime, liver of sulphur, flowers of sulphur, ammonium sulphate, lead arsenate, potassium hydrate, formaldehyde, arsenic, potassium cyanid, mercuric chlorid, carbolic acid, nicotin sulphate, and iron sulphate. Definite injury to the trees was produced by copper sulphate, carbon disulphid, calcium carbid, and chloral hydrate, especially where the larger amounts were used. All trees treated with copper sulphate were injured, and the larger amounts of carbon disulphid almost killed the trees. Calcium carbid did but little damage. Chloral hydrate had a very decided injurious effect, especially upon the tree receiving the larger application. Fertilizer treatments appeared to be ineffective.

Snapdragon rust and its control (*New Hampshire Sta. Bul. 208 (1923), p. 25*).—In experiments on the field control of the snapdragon rust, it has been definitely ascertained by O. Butler that neither sulphur nor the copper fungicides will afford the necessary degree of protection.

Decays and discolorations in airplane woods, J. S. Boyce (*U. S. Dept. Agr. Bul. 1128 (1923), pp. 52, pls. 7, figs. 9*).—The purpose of this bulletin is to enumerate and describe the more important decays, discolorations, and other real or apparent defects to which woods used in aircraft construction are subject and the causations due to which they occur. Forms and indications of decay are briefly discussed. A number of colored plates and 75 references to available literature are also given.

ECONOMIC ZOOLOGY—ENTOMOLOGY.

How to get rid of rats, J. Silver (*U. S. Dept. Agr., Farmers' Bul. 1302 (1923), pp. II+14, figs. 8*).—This is a practical summary of information.

Migration records from wild ducks and other birds banded in the Salt Lake Valley, Utah, A. Wetmore (*U. S. Dept. Agr. Bul. 1145 (1923), pp. 16, pls. 2, fig. 1*).—This is a report on a study of the migratory movements of waterfowl and other birds, based on banding operations carried on in Utah from 1914 to 1916, while engaged in the study of an alkali poisoning prevalent among waterfowl in the Salt Lake marshes, accounts of which have been previously noted (E. S. R., 41, p. 581; 45, p. 250). In the course of the work bands were placed on 1,241 individuals of 23 species of birds of large or medium size belonging to various families, the majority on wild ducks of 9 species, including mallard, gadwall, green-winged teal, cinnamon teal, shoveler or spoonbill, pintail, and redhead, the details of which are presented, partly in tabular form. Of the whole number banded, 994 were ducks, of which 174, or a little more than 17 per cent, were recovered.

[Entomological investigations at the New Hampshire Station] (*New Hampshire Sta. Bul. 208 (1923), pp. 11, 12, 23, 24*).—Investigations carried on during the season of 1922 with the tobacco dust lime mixture have led to the following summary:

"Adult flies of the cabbage root maggot do not lay eggs freely on or near plants freshly treated with the tobacco dust lime mixture. When eggs are laid

in contact with tobacco dust lime mixture, a large percentage of nonhatch results. In the work of 1922 the nonhatch was 100 per cent in the case of eggs placed in contact with the mixture, whereas the nonhatch was 0 per cent in the checks, where eggs were placed in contact with soil.

"The heavy percentage of nonhatch persists whether the eggs are placed on the surface of the mixture or are inserted slightly below the surface. The percentage of nonhatch is high whether the material remains dry or is wet down. The results indicated no difference due to the addition of moisture. Protection to cabbage plants in the field from the use of the mixture diminishes rapidly when heavy rains intervene. This appears to be due largely to the fact that rain packs the mixture down, and the movement of the cabbage plant in the wind then opens a small space next to the stem. The female fly drops eggs down into this space.

"Protection of cabbage plants during the first two or three weeks after they are set out is the most important phase of the treatment. The plants will withstand heavy attack by maggots after they have established their root system. This protection of newly set plants is readily attained by the use of the tobacco dust lime mixture. Protection of plants that are drilled in, such as radishes, is easily secured by the use of the mixture. Such plants do not sway in the wind as do cabbage plants. In 1922 the percentage of radishes free from maggot attack or only slightly infested in the treated rows was 81.2, whereas the percentage in the untreated rows was 45.5."

Brief reference is made to spraying for control of the apple maggot, conducted during the third season, and to control work carried on with black flies.

[Economic insects in Ohio] (*Ohio Sta. Bul. 362 (1923), pp. XXIX–XXXV, figs. 2*).—Insects with which work was conducted during the year and are here reported upon include the Hessian fly, European corn borer, aphids, and the European red mite (*Paratetranychus pilosus* C. & F.), which was discovered in an orchard at Hubbard. A brief discussion is given of the use of the airplane in forest insect control, as shown by tests by the station in cooperation with the Federal Aviation Experiment Station at Dayton.

Insect pest survey work in the United States, J. A. Hyslop (*Jour. Econ. Ent., 16 (1923), No. 2, pp. 215–221*).—This is a review of the insect pest survey work now under way.

Important foreign insects collected on imported nursery stock in 1922, E. R. Sasscer (*Jour. Econ, Ent., 16 (1923), No. 2, pp. 152–158*).—This is a summary of the more important insects intercepted on foreign nursery stock arriving in the United States in 1922.

Uniformity of nursery stock fumigation requirements, G. F. Arnold (*Jour. Econ. Ent., 16 (1923), No. 2, pp. 161–168*).—The author favors the adoption by the States in each section of similar fumigation requirements for each kind of plant to be fumigated.

Insect pests of cotton in St. Croix and means of combating them, C. E. Wilson (*Virgin Islands Sta. Bul. 3 (1923), pp. II+20, figs. 21*).—In this bulletin the author describes the life history of some of the insects thus far known to attack cotton in St. Croix and means for combating the more destructive species. The pests considered include the cotton worm (*Alabama argillacea*), blister mite (*Eriophyes gossypii*), fall army worm, cotton-boll cutworms (*Prodenia ornithogalli* and *P. latifascia*), West Indian sugar cane root borer (*Diaprepes abbreviatus*), tropical cutworm (*Xylomiges sunia*), cotton aphid, cotton lace-bug (*Corythucha gossypii*), red spider (*Tetranychus telarius*), and a number of other pests which attack the leaf and stem, and the pink bollworm, southern green stink-bug (*Nezara viridula*), cotton stainer, bollworm,

flower-bud maggot (*Contarinia gossypii*), St. Croix bollworm (*Heliothis virescens*), pink scavenger worm (*Pyroderces rileyi*), plant-bug (*Phthia picta*), spined stink-bug (*Arvelius albopunctatus*), and the large squash bug (*Leptoglossus gonogara*), which attack the boll and flower.

Spreader tests on apples and peaches, L. A. Stearns and W. S. Hough (*Jour. Econ. Ent., 16 (1923), No. 2, pp. 198–201*).—Orchard tests by the Virginia State Crop Pest Commission conducted in 1922, in which Kayso, a prepared casein spreader, and Magnet Dry Paste, a prepared flour-paste spreader, were used, showed that neither increased the effectiveness of the spray solution in protecting the fruit from insects and diseases. The authors doubt whether the addition of such spreaders pay for the increased cost of the spray.

Spreaders in relation to theory and practice in spraying, R. H. Smith (*Jour. Econ. Ent., 16 (1923), No. 2, pp. 201–207*).—The author finds that a suitable spreader such as calcium caseinate increased efficiency, as shown by tests with the codling moth, apple aphid, and woolly apple aphid.

The blackberry psyllid, Trioza tripunctata Fitch, A. Peterson (*New Jersey Stas. Bul. 378 (1923), pp. 5–32, figs. 35*).—This is a report of studies of the life history and habits of *T. tripunctata*, which in New Jersey attacks all varieties of cultivated blackberries, of its natural enemies, and of means of control. It is a troublesome pest in several southern counties in New Jersey, occurring only where blackberries are grown adjacent to woodland or ornamental plantings possessing conifer trees which belong to the family Pinacea. It has been found passing the winter among the needles of spruce, pine, and cedar trees.

"Late in May and early in June all of the adults (females) migrate to blackberry bushes. The great majority go to cultivated blackberry plants. Very few are found on wild blackberry bushes. The females collect in numbers on the new shoots of the blackberry, and their feeding habit apparently causes the new canes and leaves to become greatly curled, stunted, and dark green in color. This injury increases and continues throughout the season. Numerous small eggs are deposited by the females on the injured portions of the plant during the month of June and early in July. These hatch in about 10 days, and then the young nymphs continue to live on the inner side of the curled leaves and shoots. They go through five instars during July, August, and September, and early in October males and females are developed. All of the females and, so far as is known, about one-half of the males migrate to the conifers in October and early in November. This makes one complete generation per year.

"This pest can be controlled by spraying females with nicotin sulphate and soap on their return to the blackberry bushes late in May and early in June. Two or three applications are necessary. Dusting the adults with nicotin dust has not proved to be as satisfactory as spraying. Dusting is less efficient, and the cost is greater. The infestation can be reduced and almost eliminated if the grower will cut off and destroy at once all of the shoots on which adults, eggs, and nymphs occur. This should be done early in June after the migration from winter quarters is complete. To reduce materially or eliminate the infestation in a community for another season, all growers in the community must cut off and destroy the infested canes in their plantings some time between June 10 and September 1."

A bibliography of 20 references is included.

Influence of temperature and evaporation upon the development of Aphis pomi DeG., F. H. Lathrop (*Jour. Agr. Research [U. S.], 23 (1923), No. 12, pp. 969–987, figs. 8*).—The author reports in detail upon the results of in-

vestigations conducted, much of the data relating to which are presented in tabular and chart form. He finds that under normal outdoor conditions there is a general correlation between atmospheric evaporation and the rate of development of *A. pomi*.

"Atmospheric evaporation, as measured by the standard evaporimeter used, does not serve as a satisfactory index to the rate of development of *A. pomi*. Temperature, during periods when no other factor limits the rate of development of the species, constitutes a more satisfactory index than does the rate of atmospheric evaporation. The relation of temperature to the rate of development of *A. pomi* may be represented by a hyperbolic curve having the formula:

$$\text{Length of developmental period in days} = \frac{180}{\text{Temperature in degrees Fahrenheit} - 41.}$$

Plant growth frequently constitutes a factor limiting the rate of development of *A. pomi* feeding on slowly growing foliage."

Experiments on the control of the woolly aphid, E. N. Cory (*Maryland Sta. Bul. 252 (1923), pp. 25–36*).—This is a report of investigations of the effectiveness of pine tar creosote emulsion on nursery stock infested with woolly apple aphid, conducted in continuation of the preliminary work previously noted (E. S. R., 34, p. 62). The experiments were begun in 1916 and completed in 1919, the details being presented in tabular form, and with the following conclusions:

"Five and 8 per cent solutions of pine tar oils will kill the woolly aphid and repel ants. Fifteen and 20 per cent solutions are likely to cause injury to apple nursery trees. Any strength of pine tar oils held in close contact with nursery trees by poorly drained earth is likely to result in injury to the roots. Two applications per year of an 8 per cent solution seems to offer the best promise for control of the plant lice with a minimum opportunity for injury to the tree. Repetition of the two applications per year for three years caused a considerable amount of injury."

A serious pest of the grape is now present in Florida, J. Chaffin (*Fla. Plant Bd. Quart. Bul., 7 (1923), No. 3, pp. 165, 166, fig. 1*).—Baker's mealybug (*Pseudococcus maritimus* Ehrh.), previously collected from avocado, sweet potato, and tomato on Dry Tortugas Island near Key West, has been taken on cedar in the vicinity of Hudson and Port Richey, Fla.

Preliminary report on control of San José scale with lubricating-oil emulsion, A. J. Ackerman (*U. S. Dept. Agr., Dept. Circ. 263 (1923), pp. 18, figs. 6*).—This is a preliminary report of experiments conducted in the Ozark region of Arkansas, which gives the results observed to date in the experiments with lubricating oils for the control of the San José scale, together with methods for the preparation of the emulsion and recommendations for the use of the insecticide. An advance announcement of the work, by Quaintance, has been noted (E. S. R., 47, p. 453).

It was found that the San José scale, which has been increasing in such alarming numbers during the last two years in several localities of the Ozark region as to threaten the destruction of the apple industry, can be controlled by a spray application in the dormant season, with a so-called paraffin-oil or lubricating-oil emulsion. Thorough spraying, made at any time during the dormant season when the weather is fit for spraying, with an emulsion containing 2 per cent of oil should clean up bad infestations of the scale. It is advisable to make two dormant sprays in orchards that are incrusted with the scale. No indication of injury to trees from the use of lubricating-oil emulsion as a dormant spray has been observed following its use for one season in commercial orchards of Arkansas.

Shall we change our recommendations for San José scale control? W. P. FLINT (*Jour. Econ. Ent., 16 (1923), No. 2, pp. 209–215*).—The author reports upon experimental work conducted in the spring of 1922 with miscible oil and lubricating oil emulsion, as a result of which the lubricating oil will be generally used in southern Illinois during 1923. The lubricating oil emulsion gave nearly as good control of the scale as did the miscible oil, and a much higher degree of control than was obtained from the best grades of liquid lime sulphur.

The citricola scale in Japan, and its synonymy, C. P. CLAUSEN (*Jour. Econ. Ent., 16 (1923), No. 2, pp. 225, 226*).—This is a report upon observations made during the seasons 1916 and 1917, while the author was studying the citrus insects of Japan. The California infestation by citrocola scale is considered as having been of oriental origin.

The Chinese white-wax scale, Ericerus pela Chav., I. KUWANA (*Philippine Jour. Sci., 22 (1923), No. 4, pp. 393–405, pls. 2*).—This is a report of studies of *E. pela* at Yokohama, Japan, which extended over a period of two years. Detailed descriptions of its life stages are followed by notes on its life history and habits based upon personal observations at the Imperial Plant Quarantine Station. A list of 20 references to the literature is included.

The present status of the gipsy moth in New Jersey, T. J. HEADLEE (*Jour. Econ. Ent., 16 (1923), No. 2, pp. 158–161*).—The work of control conducted in New Jersey is reported upon.

The maple case-bearer, Paraclemensia acerifoliella Fitch, G. W. HERRICK (*New York Cornell Sta. Bul. 417 (1923), pp. 3–15, figs. 13*).—This is a report of studies of the small tineid-like moth of the maple case-bearer, which during the past three or four years has become so abundant, and its caterpillars have proved so destructive to sugar maples that the owners of many groves have been alarmed over the prospects of the destruction of their trees.

The insect is apparently a native species which was first observed in New York in the summer of 1850 by A. Fitch. It appears to be widely distributed over the northeastern United States and southern Canada, having been recorded from Vermont, New York, and New Jersey, westward to Illinois, in the United States, and from the Provinces of Quebec and British Columbia in Canada. It has a special liking for hard, or sugar, maple, but the moths could not be induced to deposit eggs on red maple although the larvae lived and throve thereon.

Its presence is first observed in the grove during the first half of June, when the leaves begin to lighten in color owing to the multitude of tiny blotch mines in which the young larvae have already eaten out the green tissues. The winter is passed as a pupa on the ground among the fallen leaves. In breeding cages at Ithaca the moths issued through the middle and latter half of May, beginning on May 11 and continuing up to May 23 in 1921. The eggs, which are deposited in pear-shaped pockets in the tissues of the leaf just beneath the lower epidermis, hatch in about one week, and the young larvae begin at once to mine in the tissues of the leaf, continuing as miners for probably about 10 days. On completing its growth in the mine, the larvae cuts its oval case out of the mine, apparently always making the lower piece slightly larger than the upper. The larvae live as case-bearers during July, August, and September. Observations indicate that a great majority, instead of waiting for the leaves to fall, become active in September, migrate with their cases from the foliage, and finally, of their own volition, go down the trunks of the trees to the ground or drop down on silken threads.

The species has been remarkably free from parasites during the past few years. Control measures are briefly considered, and a list of 15 references to the literature cited is inclined.

Rapid spread of the apple and thorn skeletonizer, Hemerophila pariana Clerck, W. E. BRITTON (*Jour. Econ. Ent., 16 (1923), No. 2, pp. 207–209*).—An account of the dissemination of this pest, which was first observed in Connecticut at Greenwich in 1920. During 1922 it became very abundant about New Haven, nearly all unsprayed apple trees turning brown from its attacks, and it is now known to occur throughout the State. It was also observed at Huntington and Amherst, Mass.

Pyrausta nubilalis Hub., A. I. DOBRODEEV (*Trudy 2. Vseross. Ént. Fitopat. Sezda, Petrograd, 1920, pp. 123–128*).—This is a report of observations of the European corn borer in Russia, where it is parasitized by *Ceromasia interrupta* and an ichneumonid.

Progress report of investigations relating to repellents, attractants, and larvicides for the screw worm and other flies, F. C. BISHOPP, F. C. COOK, D. C. PARMAN, and E. W. LAAKE (*Jour. Econ. Ent., 16 (1923), No. 2, pp. 222–224*).—This is a discussion of the progress of work, in which over 200 chemicals have been tested. It has been found that a mixture of one part furfural to four parts pine tar oil is a very effective repellent for practical use, while as a larvicide for use on wounds benzol is satisfactory.

The pepper maggot, a new pest of peppers and eggplants (Spilographa electa Say), A. PETERSON (*New Jersey Stas. Bul. 373 (1923), pp. 5–23, figs. 34*).—Investigations conducted by the author in New Jersey and here reported have shown *S. electa* to be the dipteran which has given the growers of certain varieties of peppers in that State so much trouble. This dipteran seems to be increasing in numbers, and should the pest continue to widen its range of food plants among the Solanacea it may prove to be one of first importance. The maggot has been a serious enemy of certain round varieties of peppers, particularly squash (cheese), and cherry, and is also abundant in bullnose peppers. It has also been found in the fruits of eggplants.

The insect has one generation a year, so far as is known. An egg is placed in the wall of a small pepper and usually projects into the cavity within. All of the eggs observed hatched in about 10 days. The space of time between the newly hatched larva and pupation varied from 12 to 22 days, with an average of 18 days. The full grown maggot enters the ground and changes to a puparium 1 to 2 in. below the surface, some maggots possibly going deeper, while occasionally a puparium is found in the fruit. Thus far no control measures have been found. A list is given of eight references to the literature.

Biological notes on the hen flea, Echidnophaga gallinacea Westw., D. C. PARMAN (*Jour. Agr. Research [U. S.], 23 (1923), No. 12, pp. 1007–1009*).—The author describes the method used in studying the life history of *E. gallinacea*, reports upon the incubation of the egg, larval development, pupal period, adult development and habits, and the total period of development, longevity of adult fleas, and conditions affecting abundance. The incubation period of the egg was found to vary from 4 to 14 days, but usually is from 6 to 8 days. About 43° F. is considered a fatal temperature for the eggs. The minimum larval period was 14 days and the maximum 31 days; the fatal minimum temperature is about 50°. The pupal period was found to be from 9 to 19 days. The adults remained attached on the host from 4 to 19 days in the same place. They were found to be killed by a freezing temperature, and to die within a few hours when exposed in tubes in an incu-

bator at a temperature of 100°. The minimum period from oviposition to the emergence of the adult was 30 days and the maximum period 65 days.

Tree borers and their control, A. L. LOVETT (*Oregon Sta. Circ. 39 (1923), pp. 3–7, figs. 4*).—This is a practical summary of information on borers of orchard trees in general, with the exception of the well-known western peach and prune root borer, which has been treated separately (E. S. R., 44, p. 850).

A weevil destructive to snowdrop bulbs (*Jour. Min. Agr. [Gt. Brit.], 29 (1923), No. 10, pp. 951, 952, pl. 1*).—A large number of the snowdrop bulbs in a consignment received in July from Smyrna were infested by a species of Brachycerus.

Relation of the Texas Agricultural Experiment Station to beekeeping in Texas, M. C. TANQUARY (*Jour. Econ. Ent., 16 (1923), No. 2, pp. 113–117*).—This is a discussion of the investigational work in beekeeping conducted by the Texas Station near San Antonio, which was presented as the annual address by the chairman of the section of apiculture of the American Association of Economic Entomologists, at Boston, in December, 1922.

A two-year brood curve for a single colony of bees, W. J. NOLAN (*Jour. Econ. Ent., 16 (1923), No. 2, pp. 117–124, fig. 1*).—In this paper the author reviews earlier work on the subject and reports upon investigations conducted by the U. S. D. A. Bureau of Entomology at Somerset, Md., commenced in 1920, in which weekly counts were made, seasonal records for 53 colonies now being available.

"The following general conclusions may be drawn from the curves presented here, assuming sufficient bees in the spring, a good queen, plenty of stores, good combs, and proper insulation: There is direct relation between nectar flows and brood-rearing activity. This also holds true for incoming pollen. Prolonged inclement weather may retard brood rearing in the spring, although a strong colony may be able to maintain its rate through unfavorable, cold weather of only a few days duration, even though it is unpacked. Under such conditions as obtain naturally from year to year a strong colony tends to retain its strength, as is evidenced by the remarkable similarity in brood curves found during two successive seasons in the same colony."

Value of winter protection for bees, J. H. MERRILL (*Jour. Econ. Ent., 16 (1923), No. 2, pp. 125–130*).—Observations at the Kansas Experiment Station extending over a period of four years show that a windbreak made an average difference of 8,600 bees in a one-story, unpacked hive, 7,968 in a two-story, unpacked hive, and 3,539 in a packed hive, indicating that packing will to a certain extent offset the disadvantage if a windbreak is not available.

Protecting American bees against the introduction of the Isle of Wight disease, S. B. FRACKER, C. B. GOODERHAM, and G. H. REA (*Jour. Econ. Ent., 16 (1923), No. 2, pp. 133–136*).—A discussion of the attempt being made to prevent the introduction of *Acarapis woodi* Ren., including a reprint of the act passed by Congress in September, 1922.

Agamermis decaudata C., S., & C., a nema parasite of grasshoppers and other insects, N. A. COBB, G. STEINER, and J. R. CHRISTIE (*Jour. Agr. Research [U. S.], 23 (1923), No. 11, pp. 921–926*).—This is a preliminary account of a joint investigation made at Washington, D. C., and Falls Church, Va., by the U. S. D. A. Bureau of Plant Industry with the cooperation of the Bureau of Entomology, of a nematode, *A. decaudata* n. g. and n. sp., which parasitizes insects, particularly Orthoptera. In the course of the investigation aid was received from approximately 150 American zoologists and entomologists.

The investigation shows positively that, in certain cases believed to be typical, *A. decaudata* is an important factor in the birth rate of certan injurious insects, and that the parasite may be made use of by colonization through trans-

ferring diseased insects or by transferring the parasite itself in one form or another. In the early part of July, 1922, grasshoppers in the vicinity of Falls Church were infested by a mermithid parasite, from which time up to cold weather 3,332 grasshoppers were examined. Of 824 Tittigonidae included in this number, very nearly all were *Orchelimum vulgare* Har., and of the remaining 2,508 Acrididae about 90 per cent were *Melanoplus femur-rubrum* Deg. Mermithid infestation was found to average 12 per cent, increasing to about 25 per cent in heavily infested regions. Records based on the examination of 2,498 grasshoppers show the males and females to be about equally parasitized.

The parasites begin to leave the hosts by the latter part of August, if not before, and are nearly all out by October 1. Once free from the host they make their way into the soil to a depth of 3 to 20 cm., the females going down from 4 to 8 cm., seldom deeper. Here they coil up in the nest, forming a knot, and apparently never again move about. The males move through the soil more freely. Eggs are laid in large numbers until both the nematodes and the walls of the nest become plastered with them, each female laying an average of 5,000 eggs. Hatching is thought to be brought about by the warm spring weather, whereupon the larvae work their way to the surface of the soil and enter the newly hatched grasshopper nymphs. Artificially infested grasshoppers containing six or eight mermithids were found to die in about eight days.

An account is given of the structure and behavior of the free-living larva. A list of eight references to the literature cited is included.

FOODS—HUMAN NUTRITION.

The essentials of chemical physiology, W. D. Halliburton (*London and New York: Longmans, Green & Co., 1922, 11. ed., pp. XI+343, pl. 1, figs. 70*).—This volume differs but little from the previous edition (E. S. R., 43, p. 365).

Further contributions to the knowledge of organic foodstuffs with specific action, XIX–XXII, E. Abderhalden (*Pfluger's Arch. Physiol., 197 (1922), No. 1–2, pp. 89–130, figs. 37*).—In continuation of the series of papers previously noted (E. S. R., 48, p. 556), four papers are presented.

XIX. *Comparative feeding experiments with flesh of normal pigeons and of pigeons exclusively fed on polished rice* (pp. 89–96).—This is a continuation of the work reported in Paper XVI of the series. Weight and temperature curves are given for 2 pigeons fed, respectively, on a mixture of muscle and various organs of normally-fed and of polished rice-fed pigeons, with additions from time to time of maltose, sugar, yeast, etc. Determinations of the gaseous metabolism during part of the experiment were also made.

The weight curves in both cases showed a gradual though somewhat irregular loss in weight which was not checked perceptibly by the addition of yeast. The pigeon fed the flesh of a normal pigeon died on the one-hundred and thirtieth day. The other pigeon was then given a supplement of fatty acids and glycerin which brought about a temporary increase in weight, but death occurred on the one-hundred and thirty-eighth day. The chief difference noted in the comparison of the 2 pigeons was that the addition of yeast to the diet of the pigeon fed on the flesh of the polished rice-fed pigeon caused a greater increase in gaseous metabolism than in the other case. The significance of these findings is discussed at length, as illustrating the author's theory that the chief function of vitamins is to regulate cellular metabolism.

XX. *Comparative feeding experiments with various foodstuffs* (pp. 97–104).—This is a continuation of the investigation reported in Paper XVIII. The polyneuritis induced in pigeons by the diet previously described yielded to

treatment with yeast extract in the same manner as the polyneuritis induced by polished rice feeding.

XXI. *Experiments with pure foodstuffs with a predominance of carbohydrates or a fatty acid-glycerin mixture* (pp. 105-120).—To determine whether the vitamins are of significance in themselves or whether the need of them is dependent upon the relative proportions of other constituents of the diet, the following feeding experiments were made: A group of pigeons was fed a mixture of carefully purified casein 5, salt mixture 5, and either cane sugar 10 or a mixture of fatty acids and glycerin 5 gm. In another series of experiments the pigeons were given as sole nourishment either glucose or a mixture of purified fatty acids and glycerin. In the third series pigeons which had been kept for 20 days on a sole diet of polished rice were fed daily 15 gm. of rice, together with glucose or a fatty-acid glycerin mixture. In some cases the effect of the administration of yeast was noted.

In the first group 2 pigeons fed the mixture of casein, salts, fatty acids, and glycerin showed a progressive loss in weight, but no significant loss in body temperature and no symptoms of alimentary dystrophy (polyneuritis). The administration of yeast was without effect. In the group of 3 pigeons receiving glucose in place of the fatty acid-glycerin mixture, there was a rapid loss in body weight and in body temperature, followed in from 10 to 23 days by symptoms of polyneuritis which were relieved by the administration of yeast. Similar results were obtained in the pigeons fed fatty acids and glycerin or glucose alone, polyneuritis developing only in the latter case. Again the administration of yeast proved effective in controlling these symptoms and increasing the lowered gaseous metabolism.

In the group of pigeons which had been fed for 3 weeks on polished rice, those receiving subsequently fatty acids and glycerin did not develop polyneuritis, but continued to lose weight; those fed glucose developed severe symptoms of polyneuritis in 6, 12, and 10 days, respectively, with in all but one case a decided fall in temperature; and the controls, continued on the polished rice diet alone, died in 7, 8, and 13 days after a loss in temperature and lowered respiration, but with no convulsions.

To test further the influence of carbohydrates on polyneuritis, normal pigeons and pigeons fed for some time on polished rice were given intramuscular injections of from 1 to 2 gm. of various carbohydrates in 10 per cent solution and the subsequent behavior and body temperature noted. In these experiments no difference could be noted in the behavior of the 2 groups. In all cases there was a lowering of body temperature, but only seldom did convulsions occur.

It is further noted that the livers of polyneuritic pigeons contain no glycogen.

These results are thought to point to the significance of vitamin B in carbohydrate metabolism and to the assumption that the symptoms of polyneuritis are not only caused by the lack of unknown substances in the food, but that of even greater significance is the proportion of carbohydrate to the other food constituents. It is suggested that polyneuritis may be considered to be a form of deficiency disease of exogenous nature and *Diabetes mellitus* a similar deficiency disease of endogenous nature.

XXII. *Feeding of pigeons with meat alone or with additions* (pp. 121–130).—In the experiments reported in this paper pigeons were fed fresh meat (horse or beef) in varying amounts, with or without small additions of various carbohydrates or fatty acids and glycerin or yeast. Tables and growth curves are given of representative experiments in the series. These show that pigeons can be kept in maintenance or with slight increase in weight for sev-

ral months on meat alone, provided it is given in suitable amounts. For a body weight of 400 gm. from 30 to 35 gm. of fresh meat is considered sufficient, and if carbohydrates and fatty acids are given in small amounts 25 gm. of meat suffices. Yeast appeared to have no favorable effect in connection with this diet.

In connection with another experiment the meat-fed pigeons and normally-fed pigeons were injected with ox plasma. The meat-fed pigeons succumbed, with evidence of anaphylactic shock, while the normal pigeons survived.

It is noted finally that pigeons have been kept for at least 2 months on completely hydrolyzed meat and glucose.

Continuation and extension of work on vegetable proteins, T. B. OSBORNE and L. B. MENDEL (*Carnegie Inst. Wash. Yearbook 21 (1922), pp. 373–381*).—The investigations summarized in this annual report, continuing the work of the previous year (E. S. R., 47, p. 364), have been noted for the most part from other sources. These include a study of the vitamin B requirement for rats (E. S. R., 49, p. 62); the vitamin B content of milk, of egg yolk, of oranges, and of various vegetables (E. S. R., 47, p. 861; 49, p. 161; 47, pp. 267, 465) the studies by Yudkin and Lambert on the pathology of the eye in relation to ophthalmia (E. S. R., 48, p. 863); of Osborne, Wakeman, and Leavenworth on the water-soluble constituents of the alfalfa plant (E. S. R., 48, p. 201); and of Vickery on the hydrolysis of wheat gliadin (E. S. R., 48, p. 202).

A further study is reported of the effects upon growth and nutrition of the use of food mixtures containing unusual proportions of protein, fat, and carbohydrate (E. S. R., 45, p. 764). In the more recent experiments some animals have grown at a normal rate to a weight of more than 260 gm. on diets of which 90 per cent was protein, but none of the animals has reached the average adult size of rats on diets containing 18 per cent of protein. If the animals which have reached a size of about 250 gm. are changed to a diet containing only 18 per cent of protein a gain in weight generally results. Young animals which are fed a diet the protein of which does not exceed 80 per cent generally reach a larger size than animals on the 90 per cent protein. In these high protein diets the amount of food eaten is no greater than of food mixtures of equal caloric value but containing a liberal amount of carbohydrate and less protein, thus indicating that protein meets the energy requirement practically as well as carbohydrate.

On diets containing at least 75 per cent of fat and very little carbohydrate, young rats grow at somewhat less than normal rate to a weight of about 280 gm. With larger amounts of fat growth does not take place, on account of the very small amount of food consumed as a result of the high caloric value of the fat.

In a further study of the question of the capacity to grow after long periods of stunting of growth, earlier studies on the suppression of growth through the use of gliadin, which is deficient in lysin, have been repeated and extended. Rats which have been maintained at 100-gm. weight for periods of 100 and 200 days, respectively, have been found not to have lost their ultimate capacity to grow when placed on adequate diet. In some of these experiments the diets were lacking in vitamin A. On such diets the animals developed ophthalmia, which was cured by the administration of cod liver oil, while constant weight was maintained. This is thought of significance in view of the earlier belief that the pathological effects of vitamin A do not manifest themselves except when growth is taking place.

On diets in which 80 per cent of the otherwise adequate food mixture consisted of gliadin, rats from 30 to 40 days old were able to double their weight

in 45 days, showing that growth is possible on gliadin as the sole protein provided sufficient is given to furnish an adequate quantity of lysin.

The supplementary protein value of peanut flour, W. H. Eddy and R. S. Eckman (*Jour. Biol. Chem., 55 (1923), No. 2, pp. 119–129, figs. 3*).—As a part of a cooperative investigation on the practical utilization of peanut flour in cookery, the authors have conducted on rats a long-period test of the protein-supplementing value of peanut flour for wheat flour, controlling the experiment against muscle protein.

Preliminary short-time tests were conducted in which a comparison was made of the growth-promoting properties of a baking powder biscuit in which in one case patent wheat flour was used as the only flour and in the other about 25 per cent of the wheat flour was substituted by peanut flour. A similar comparison was also made of yeast rolls made with all patent flour and with 75 per cent patent flour and 25 per cent peanut flour. In a 22-day period the peanut-supplemented breads showed definite superiority as growth producers.

For the main experiment two rations were made up to contain approximately 9 per cent of protein. The first consisted of peanut flour, 213; wheat flour, 1,818; butter fat, 100; starch, 1,079; and McCollum's salt mixture 123 gm. The second ration consisted of meat residue, 170; wheat flour, 1,818; butter fat, 100; starch, 1,122; and salt mixture 123 gm. Selected litters of white rats 45 days old were fed these diets until about 390 days of age. The animals were allowed to breed and the offspring continued on the diets. Growth curves are given of the first generation in each series, comprising 5 animals on the peanut-wheat ration and 6 on the meat-wheat ration, and of one of the female rats in the peanut series and three generations of her offspring. Tables are also given of the comparative reproduction records and the food intake records in both series.

The rats of the first generation on the peanut-wheat ration compared favorably with normal rats in growth and reproduction. Those on the meat-wheat ration grew at about the normal rate, but none of the second generation survived more than 31 days. The reproduction records of 3 rats on the peanut-wheat ration gave a total of 45 young with 15 survivals, and of the same number on the meat-wheat ration 47 young with no survivals beyond the thirty-first day.

In the case of the best female of the first group, two of the offspring produced a third generation. It is noted, however, that reproduction occurred somewhat later in the second generation. It is suggested that this may have been due to a deficiency of vitamin A in the diet.

The food intake records of 4 animals in each series showed that in the first the average amounts of food and protein were 12.8 and 1.28 and in the second 12 and 1.2 gm., respectively.

The authors conclude that the peanut-flour mixture ranks with the meat-flour in the quality of its protein with respect to growth, and is markedly superior to the latter in regard to reproduction.

The excretion of foreign protein in human milk, H. C. Stuart (*Amer. Jour. Diseases Children, 25 (1923), No. 2, pp. 135–156, figs. 4*).—Exception is taken to the methods employed by Shannon in testing human milk for egg protein (E. S. R., 46, p. 564) and to his interpretation of results. A number of experiments are reported in which attempts were made to demonstrate egg protein in breast milk by intravenous injection into sensitized guinea pigs or by the Dale uterine strip method. In no case were positive results obtained.

The author states in conclusion that the explanation of the frequent findings of positive reactions to egg protein in infants fed exclusively on breast milk has not as yet been given, and that the problem should be investigated further.

Fats and carbohydrates in nutrition, S. Visco (*Riv. Biol., 4 (1922), Nos. 1, pp. 1–13, pp. 339–343, figs. 3*).—The literature on the relative protein-sparing action of carbohydrates and fats is reviewed and discussed, particular attention being given to the work of Maignon leading to the conclusion that fats are better protein-sparers than carbohydrates (E. S. R., 41, p. 669). Following this discussion, data are reported on a series of metabolism experiments conducted on rats with a view to throwing some light on this question.

Three adult rats weighing, respectively, 247, 203, and 153 gm. were fed for 4 7-day periods on diets of purified casein, with fat or starch in amounts to furnish various ratios of protein to fat or carbohydrate, and with in each case 2 per cent of milk ash and in some cases a small amount of gelatin. The various diets for the first animal, as illustrating the general plan, are as follows: (1) Casein 72, gelatin 2, fat 24, and milk ash 2 per cent (protein : fat =1:1/3); (2) casein 47, gelatin 2, fat 49, and milk ash 2 per cent (protein : fat=1:1); (3) casein 47, gelatin 2, starch 49, and milk ash 2 per cent (protein : carbohydrate=1:1); and (4) casein 32, starch 66, and milk ash 2 per cent (protein : carbohydrate=1:2). The data reported include the daily amounts in grams of nitrogen ingested and eliminated in the feces and urine, with calculated values for nitrogen absorbed and for the nitrogen balance. The gain or loss in weight for each period is given, and the total values for each period are also calculated in percentages of the original amounts. The more significant data from the three series of experiments are presented in the following table:

Metabolism data on varying protein-fat and protein-carbohydrate ratios.

RAT I.

Ratio of dietary constituents.	Nitrogen absorbed.	Nitrogen eliminated in urine.	Nitrogen balance.	Gain in weight.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*
Protein : fat=1 : ⅓	87.10	80.95	19.05	+4.4
Protein : fat=1 : 1	96.20	74.34	25.66	+1.1
Protein : carbohydrate=1 : 1	94.30	63.40	36.60	−4.2
Protein : carbohydrate=1 : 2	89.40	73.65	26.35	−1.6

RAT II.

Protein : fat=1 : 1	95.70	71.50	28.50	1.4
Protein : fat=1 : 2	91.20	62.79	37.21	.9
Protein : carbohydrate=1 : 1	90.40	68.16	31.84	−4.3
Protein : carbohydrate=1 : 4	90.50	49.88	50.12	−7.5

RAT III.

Protein : fat=1 : 1	90.80	81.57	18.43	+2.6
Protein : fat=1 : 2	94.50	70.09	29.91	+1.9
Protein : carbohydrate=1 : 1	95.92	76.17	23.83	−5.6
Protein : carbohydrate=1 : 4	90.50	56.46	43.54	−5.9

These data show that, while the percentage absorption of the nitrogen as calculated from the amount ingested and the amount eliminated in the feces is higher on the protein-fat than on the protein-carbohydrate mixtures, the per-

centage of nitrogen eliminated in the urine is greater on the protein-fat diet than when protein and carbohydrate are fed in the same proportion. Consequently the nitrogen balance in percentage of the nitrogen ingested is lower when fat is used to supplement protein than when carbohydrate is used. These results confirm the conclusion of the majority of workers, but are in contradiction of Maignon in so far as the utilization of protein is concerned. They confirm Maignon's conclusions to the extent that in the proportion used there is a gain of weight on the protein-fat and a loss of weight on the protein-carbohydrate diets. It is thought that this loss in weight can not be attributed to failure to utilize or spare the proteins but rather to the difference in caloric value of the fat and carbohydrate.

The possibility that the gain in weight on the protein-fat combination was due to vitamin A is thought to be disproved by a further series of experiments in which 2 rats were fed a mixture of equal parts of casein and rice starch with 2 per cent of milk ash, and 2 others with equal parts of casein and pure olein with the same amount of milk ash. Both the casein and the starch were previously purified by repeated extraction with water, alcohol, and ether. The animals on the fat diet showed a regular gain in weight and those on the carbohydrate a loss in weight.

The secretion of gastric juice in health and disease, A. J. CARLSON (*Physiol. Rev., 3 (1923), No. 1, pp. 1–40*).—This review of the literature on gastric secretion includes an outline of methods of securing gastric secretion and determining gastric acidity, a brief discussion of the secretion of gastric juice in the lower animals and an extensive discussion of its secretion in normal mammals in health and disease. An extensive bibliography is appended.

The inorganic phosphorus of the serum and plasma of 91 normal adults as determined by the Bell and Doisy method, E. TOLSTOI (*Jour. Biol. Chem., 55 (1923), No. 2, pp. 157–160*).—Determinations by the Bell and Doisy method (E. S. R., 44, p. 613) are reported for the inorganic phosphate in the serum and oxalated plasma of a number of normal adults. When the serum and clot stood in contact with each other for 24 or 48 hours, high values were obtained for the serum, but if the separation was made within 3 hours the values obtained with serum and plasma showed satisfactory agreement. The range of inorganic phosphate according to the results reported for 25 cases lies between 2.5 and 3.3 mg. per 100 cc.

Is the action of Bacillus acidophilus a strictly bacteriologic phenomenon? N. KOPELOFF (*Jour. Amer. Med. Assoc., 80 (1923), No. 9, pp. 602–604*).—To determine whether the favorable action of *B. acidophilus* in milk is due to the mechanical action of the ingestion of an increased volume of liquid, to the chemical action of the lactic acid and other constituents of the milk, or to the bacterial action of living *B. acidophilus* organisms, a number of patients with chronic constipation were given for one week daily doses of 1 liter of skim milk sterilized at 20 lbs. pressure for 15 minutes. The following week some of these patients, as well as several others, were given daily 1 liter of skim milk sterilized as in the first case, but inoculated with *B. acidophilus* and incubated for 24 hours in the usual manner and then pasteurized by heating in the Arnold sterilizer for 10 minutes. To avoid extreme coagulation of the casein, the acidity caused by the fermentation was neutralized with sodium hydroxid before pasteurization and sufficient lactic acid added after pasteurization. As a control the patients were given in the third week 1 liter of the regular *B. acidophilus* milk, in most cases reinforced with lactose.

No relief from constipation was obtained in the first two series of experiments, while prompt relief resulted in the third series. This is thought to

indicate that the action of *B. acidophilus* milk is not a physical nor purely chemical phenomenon, but is essentially a bacteriological phenomenon.

It is also noted that relief from chronic constipation has persisted for six months after the ingestion of *B. acidophilus* has been discontinued, and that viable *B. acidophilus* organisms in appreciable numbers have been recovered from the feces of patients several months after the discontinuation of the *B. acidophilus* milk.

Vitamins, health, and the daily diet, J. W. Read and S. Palmer (*Arkansas Sta. Bul. 184 (1923), pp. 5–64, pls. 8, figs. 3*).—This bulletin contains a brief section on the vitamins and deficiency diseases, a general discussion of the dietary properties of certain classes and types of foods, and suggestions as to other important considerations in nutrition and health, including the causes and remedies of malnutrition, the effect of diet on the teeth, the causes of overweight, and dietary suggestions for the expectant mother. General suggestions on diet planning are followed by a typical diet for a child 2 years old and appropriate menus for adults for fall, winter, spring, and summer, menus for the farm in winter and summer, and suggestions for the school lunch with selected recipes.

Tables are given of the relative vitamin and protein values of the more common foods, the average height and weight of children from birth to 6 years at monthly intervals, the average height and weight of boys and girls at yearly intervals from 5 to 18 years, and the height and weight of men and women from 19 to 59 and 54 years, respectively. The relative amounts of iron, phosphorus, and calcium in the edible portion of several common food materials are charted.

Vitamins in the food supply, H. C. Sherman (*Survey, 49 (1923), No. 12, pp. 782–784*).—In this brief discussion of the proper choice of foods to furnish an abundant supply of vitamins, the author emphasizes the importance of milk, vegetables, and fruit.

"It may safely be said that the best way to be sure of plenty of vitamins is to make milk, vegetables, and fruit prominent in the daily food supply. Milk is essentially rich in vitamin A, with a liberal amount of vitamin B, and smaller but notable quantities of vitamin C; fruits and vegetables, while varying widely among themselves, are, as a group, our most important source of vitamin C and furnish at the same time an abundant supply of vitamin B. With a good supply of milk on the one hand and of vegetables and fruit on the other, we are sure of an abundance of all three of the vitamins."

The significance of vitamins in the exchanges of the animal body.—I, The rôle of proteins and carbohydrates in vitamin hunger, L. Tscherkes (*Biochem. Ztschr., 133 (1922), No. 1–3, pp. 75–84, figs. 2*).—The author discusses at length, with many references to the literature, the various theories advanced in explanation of the function of vitamins in metabolism. His own theory, which is illustrated by growth curves of pigeons on various diets, is that vitamins are necessary for the metabolism (both anabolism and katabolism) of both proteins and carbohydrates. In the absence of vitamins the metabolism of these food constituents is incomplete, with the result that the greater the amount of protein or carbohydrate the more serious the trouble on account of the formation of toxic substances in increasing amounts. In his opinion the biological value, according to Thomas, of different foodstuffs depends upon the relative amounts of vitamins, proteins, and carbohydrates present. Such inorganic elements as iodin, manganese, and silicon are thought to play no rôle in connection with vitamins.

Production of a growth-promoting substance by Azotobacter, O. W. Hunter (*Jour. Agr. Research [U. S.], 23 (1923), No. 10, pp. 825–831, figs. 2*).—

In this investigation, conducted at the Kansas Experiment Station, Azotobacter grown on a synthetic medium free from any known vitamins was used as the sole source of vitamin B in feeding experiments with rats, and as a curative dose for polyneuritic pigeons.

When fed as 2 per cent of the ration the dried Azotobacter proved even more satisfactory as a source of vitamin B than an equal amount of dried yeast. When fed to polyneuritic pigeons in 1 or 0.5 gm. doses it also showed marked curative action. It is concluded that if a growth-promoting substance is a requirement for the development of Azotobacter, the organism is capable of synthesizing it and that the factor thus synthesized is similar to vitamin B.

The etiology of rickets, E. A. PARK (*Physiol. Rev., 3 (1923), No. 1, pp. 106–163*).—This is an extensive review and discussion of the literature on the occurrence of rickets, theories concerning its cause, and the experimental production of rickets in animals and the knowledge derived therefrom.

In the opinion of the author "rickets is a dietetic disease, since for its development the diet must be insufficiently supplied with the factor X [the antirachitic vitamin of cod-liver oil]. At the same time it is a disease of defective hygiene, since for its development there must be an insufficient supply in the environment of the radiant energy which exerts the protective action. The facts just mentioned also explain the disagreement among the students of rickets the world over concerning the causation of the disease. Obviously two factors have been concerned, but all investigators have proceeded on the assumption that only one factor was concerned, and have perceived so clearly the existence of the one that they have denied the possibility of the existence of the other."

An extensive bibliography is appended.

A study of light waves in their relation to rickets, A. F. HESS and M. WEINSTOCK (*Jour. Amer. Med. Assoc., 80 (1923), No. 10, pp. 687–690, fig. 1*).—This is a complete report of an investigation which has been noted from a preliminary report (E. S. R., 49, p. 65). In conclusion, attention is called to the observation that "the spectrum would seem to contain not only rays which can prevent or cure rickets but also longer rays which are able to neutralize or inhibit the effect of these beneficent radiations. This phenomenon points to the need and the value of an analysis of rays employed in heliotherapy in rickets, tuberculosis, and other diseases."

The antiscorbutic value of sterilized lemon juice and the question of the doses of antiscorbutic vitamin necessary in metabolism, G. MOURIQUAND and P. MICHEL (*Compt. Rend. Soc. Biol. [Paris], 87 (1922), No. 39, pp. 1403, 1404*).—Attention is called to earlier observations that lemon juice sterilized for 1½ hours at 120° C. still retains some antiscorbutic power. To determine quantitatively the extent of destruction of vitamin C by this process, groups of guinea pigs receiving daily 40 gm. of barley were given 5, 10, 20, and 40 cc., respectively, of the sterilized lemon juice.

In the animals receiving the 5- and 10-cc. doses scurvy appeared about the twenty-fourth day, and in those receiving 20 cc. from the thirty-first to the thirty-sixth day, and those receiving 40 cc. remained well even after 63 days. These results are considered of significance in indicating that vitamin C does not act solely by its presence in the manner of a catalyzer, but quantitatively as any other food material.

[Botulism studies] (*Illinois Sta. Rpt. 1922, pp. 18, 19*).—The finding of *Bacillus botulinus*, type A, in two samples of suspected spinach is reported. Antitoxin against this type gave encouraging results in the treatment of botulism caused by this spinach and also of the infection artificially induced in pigs by feeding the spinach.

In outbreaks of a disease of chickens and ducks characterized by muscular weakness of the legs and neck, an organism was isolated which was anaerobic, nonmotile, Gram-positive, and spore-forming. This organism resembled *B. botulinus*, but was not identical with it as shown by the fact that both A and B antitoxin were ineffective against it. The possibility is suggested of a third type of *B. botulinus*.

Botulism (*Med. Sci., Abs. and Rev.*, 7 (*1923*), *No. 6, pp. 457–486*).—This review of the literature on botulism includes descriptions of typical outbreaks, particularly some of the earlier ones in Germany; a discussion of the morphology, biology, and toxigenic properties of *Bacillus botulinus;* the production, standardization, and use of botulinus toxin; and the pathological lesions of botulism.

The authors appear to have the opinion that some at least of the reported cases of botulism have not been outbreaks of genuine botulism, particularly in view of the resemblance in certain respects between botulism and lethargic encephalitis.

"The chapter of the experimentation in 'botulism' can not be considered as closed. There is urgent necessity for further work, first, in the examination of the pathogenic activities of other anaerobes conceived as food-poisoning bacteria, and secondly, for an attempt at a comparative study of all the viruses with peculiar affinities for nervous tissue.

"There should also be in every country an available supply of a polyvalent antibotulinus serum, as the only hopeful means of saving life in undoubted cases of botulin poisoning and also possibly as a useful adjuvant in experimental research on the microbial origin of various affections of the central nervous system."

An extensive list of literature references is appended.

ANIMAL PRODUCTION.

Genetic studies of rabbits and rats, W. E. CASTLE (*Carnegie Inst. Wash. Pub. 320 (1922), pp. 55, pls. 2, figs. 7*).—Two papers are reported.

I. *Size inheritance in rabbit crosses* (pp. 1–50).—To study the method of inheritance of size in rabbits, crosses were made between three races, the Polish and Himalayan (small) and the Flemish Giant (large), and the following number of adult crossbreds were obtained: Polish×Flemish F_1 27, F_2 137; Polish×Himalayan F_1 25, F_2 55; and Himalayan×Flemish F_1 17, F_2 70.

Records of the weight, ear length, skull length, anterior and posterior skull width, length of femur, length of tibia, and length of humerus were taken. Growth curves derived from the weight of each race and the weights of the F_1s are given in which the Flemish was found to be the largest, followed by the F_1s of the Himalayan-Flemish cross, Polish-Flemish, Himalayan-Polish, and the Himalayan and Polish races. The Polish rabbit is smaller because the initial weight and growth rate are less and the completion of growth comes at an earlier age than in the other races. F_1 Himalayan×Polish crosses have a greater initial weight and grow faster than either parent. The mature weight of the F_2s is intermediate between the Himalayan and the Polish. The F_1s of the Flemish-Polish or Flemish-Himalayan crosses are well above the average between the two breeds crossed. In the Polish cross maturity was attained early, but not so early as in the pure Polish. The heavy parental type was in no case recovered in the F_2 generation of the Himalayan-Flemish or

the Polish-Flemish crosses, as there was no overlapping in weight with the Flemish classes, though there was some overlapping with the weights of the smaller parents.

The ear lengths of the Polish-Himalayan crosses were very similar to the ear length of the Himalayan, indicating dominance of long ears. In the F_2 there was greater variation to include the mode of the Polish and the entire range of variation of the Himalayan. In the Himalayan-Flemish and Polish-Flemish crosses the F_1 and F_2s were just below intermediate, with greater variation in the F_2, though this variation did not extend into the range of either parent. The author concludes that numerous independent genetic factors affecting ear length are active in differentiating the parental races.

In bone measurements the Himalayan-Polish surpass the intermediate in both F_1 and F_2, but in the Flemish crosses with both breeds the F_1s and F_2s both fall below the intermediate. This was more pronounced in the F_2s.

In determining the effect of sex on the different characters, it was found that the females were from 2.5 to 7.5 per cent heavier than the males, but the bone measurements were slightly smaller.

In studying the existing correlation in the pure races and in the F_1 and F_2 crosses, it was found that high correlation existed between the size of the body and the size of the different parts, as well as between the measurements of different parts of the body. These coefficients varied from 0.741 ± 0.016 to 0.980 ± 0.004. The similarity between the correlations in the pure races and the F_1 and F_2 individuals indicates that the same factors for size affect the different parts of the body as well as the body weight and ear length.

In discussing the determiners of size, the author concludes that "inheritance of large or small size in rabbits is influenced equally by the father and by the mother. No difference can be detected between the results of reciprocal matings between large-sized and small-sized races. This indicates that sperm no less than egg is the vehicle of transmission, and makes it probable that the chromosomes are concerned in the transmission. If so, the agency may properly be a gene or genes."

The numbers of independent genes involved in determining the size of parts have been determined by a formula calculated by S. Wright from a previous paper (E. S. R., 48, p. 66):

$$n = \frac{D^2}{8(\sigma_2^2 - \sigma_1^2)}$$

in which n equals the number of independent factors involved, D is the difference between the means of the parental races, σ_1 is the standard deviation of F_1, and σ_2 is the standard deviation of F_2. The numbers of independent size factors involved in the Polish-Himalayan crosses were calculated as 2, in the Himalayan-Flemish crosses as 8.2, and in the Polish-Flemish crosses as 10.5, indicating that nearly all the chromosomes carry factors for size in the latter cases. No evidence of linkage between size and any of the simple Mendelian characters was observed. The following table gives a summary of the measurements of some of the characters on which data were taken:

Measurements of some size characters of rabbit pure races and crossbreds.

Breed.	Mature weight.		Ear length.		Skull length.		Tibia length.	
	Average.	Standard deviation.	Average.	Range.	Average.	Range.	Average.	Range.
	Gm.	*Gm.*	*Mm.*	*Mm.*	*Mm.*	*Mm.*	*Mm.*	*Mm.*
Polish	1,404	142	83.6	81–88	65.7	63–69	83.9	79–89
Himalayan	1,866	.....	94.8	92–97	68.9	66–72.5	93.9	92–96
Flemish	3,646	.....	145.3	143–147	85.5	82.5–88	111.0	105–116
Polish×Himalayan F_1	1,973	218	94.9	90–98	70.2	62–74.5	92.8	86–96
Polish×Himalayan F_2	1,652	233	92.0	85–99	68.9	65–75	89.8	80–96
Polish×Flemish F_1	2,512	198	115.6	112–119	78.9	76–82.5	99.0	95–105
Polish×Flemish F_2	2,126	257	115.7	106–129	76.5	69.5–83.5	97.3	90–105
Himalayan×Flemish F_1	2,827	162	109.3	103–116	75.5	73–79.5	96.2	92–100
Himalayan×Flemish F_2	2,472	230	107.0	93–122	73.1	63.5–80	93.4	82–104

II. *On a nontransmissible tricolor variation in rats* (pp. 51–55).—An account is given of a male tricolored rat, gray, yellow, and white, similar to tricolored guinea pigs. This condition, however, was not transmissible. Hundreds of offspring have been produced by him in matings with albinos, pink-eyed yellows, gray F_1 crossbreds between the albino and pink-eyed yellow races, and later with his daughters in the same colors. Since no tricolored offspring occurred, this condition could not be due to a recessive mutant factor. It is explained as due to an incomplete division of one pair of chromosomes in the fertilized egg, so that the genes from the sire and dam did not act upon each other in all blastomeres. Thus, the skin color of certain parts was different and controlled by different factors, as Morgan and Bridges have found to be the case in gynandromorphs in Drosophila.

Two new color factors of the guinea pig, S. WRIGHT (*Amer. Nat., 57 (1923), No. 648, pp. 42–51*).—Two new factors for determining coat color in guinea pigs have been observed in the guinea pig stock of the U. S. Department of Agriculture. One factor is a fifth allelomorph in the albino series, and is designated as c^k or dark dilution, since it causes less dilution of black than c^d (light dilution), but the action on red is about equal. c^k is recessive to C, causing intensity, but is imperfectly dominant to c^d, c^r (causing red eye, but no yellow dilution), and c^a (causing albinism).

The second new factor *f* apparently reduces red and intensifies black, and is independent of the albino series. Its action is explained as similar to the reaction between c^d and c^r in the albino series by assuming that the dilution of red is the primary action, and the intensification of black is due to a partial release of the black-producing process from competition with a tendency toward red. Further tests of this factor are still in progress.

Inheritance in Drosophila hydei.—I, White and vermillion eye colors, R. E. CLAUSEN (*American Nat., 57 (1923), No. 648, pp. 52–58*).—An account is given of a method of inheritance of two sex-linked characters which have been observed in *D. hydei*. White eye and vermilion eye color have been found to be due to the recessive factors *w* and *v*, both of which are sex linked. Since these factors were originally found separately, the amount of recombination in males was studied and found to average 9.3 per cent.

[Nutritional experiments at the Illinois Station] (*Illinois Sta. Rpt. 1922, pp. 16, 17*).—Three years' experiments with 240 pigs have indicated that "the addition of a mineral mixture to otherwise well-balanced rations apparently had little effect on the rate or the economy of the gains made either in the dry lot or on pasture."

In studying the requirement of growing and breeding swine for vitamin A, it was found that the reproductive powers of breeding sows were gradually undermined by a continued subsistence on a white corn and tankage ration. One such sow produced dead litters in the third and fourth gestation periods. Forty-eight pigs were fed on rations of white corn and tankage and 28 on yellow corn and tankage, being started at weights of 50 to 70 lbs. and being taken off the experiment at 225 lbs. Six pigs fed white corn showed pathological symptoms, and 2 of the pigs died. One lot fed white corn and 1 oz. of alfalfa meal daily showed no disturbances. Pigs fed White Silvermine corn gained about as rapidly and economically as those fed yellow corn, but the pigs receiving White Democrat corn made slower gains and required more feed.

A continuation of experiments dealing with the chemical nature and values of proteins of feeds (E. S. R., 49, p. 158) has included studies of the proteins of wheat bran, soy beans, linseed-oil meal clover hay, and the endosperms of high protein strains of white corn. The possibility of correlating the biological values of proteins with the amino acid contents of feeds is suggested. White mice have been used in feeding experiments for making direct determinations of the biological value of the protein and net protein values of the feeds.

The results on experiments dealing with the vitamin requirements for work indicate that the requirement of vitamin A is increased by work, but it has not been determined whether the requirement of vitamin B is influenced or not.

The protein efficiency of combinations of corn meal and certain other feeding stuffs, notably rice bran, L. A. MAYNARD, F. M. FRONDA, and T. C. CHEN (*Jour. Biol. Chem., 55 (1923), No. 2, pp. 145–155*).—Experiments with rats to determine the quality of protein in certain stock feeds, carried on at the New York Cornell Experiment Station, are reported. Rations containing various amounts of protein were balanced to have an equal energy value by using a mineral mixture, butter, lard, starch, and corn meal, with other sources of protein replacing all or part of the corn meal in certain cases. The feeding periods lasted 12 weeks. The following table gives a summary of the results:

Results of tests of different live stock feeds as sources of protein for rats.

Source of protein.	Protein in ration.	Number of rats.	Average gain 12 weeks.	Average food consumed.	Gain per gram of protein consumed.
	Per ct.		*Gm.*	*Gm.*	*Gm.*
Corn meal	9.02	8	87	818	1.18±0.023
Corn meal and linseed oil meal	9.02	5	82	766	1.21± .052
Corn meal and cottonseed meal	9.02	5	91	829	1.23± .046
Corn meal and peanut oil meal	9.02	5	125	946	1.46± .052
Corn meal and soy bean oil meal	9.02	5	131	826	1.76± .046
Corn meal and rice bran	9.02	5	135	920	1.63± .036
Peanut oil meal	9.02	4	97	743	1.45± .046
Rice bran	9.02	5	102	768	1.47± .055
Corn meal and rice bran	8.00	5	133	962	1.71± .017
Corn meal and rice bran	7.00	5	73	809	1.29± .053
Rice bran	10.00	4	106	836	1.26± .038
Rice bran	8.00	4	76	846	1.12± .066
Corn meal	8.00	5	78	956	1.00± .042

When soy beans supplied the only source of protein, the rats would not eat it and practically no growth occurred. Mixtures of corn meal and rice bran or soy bean oil meal as sources of protein produced better growth than any of these

feeds alone, indicating a supplemental action between the proteins of corn meal and the proteins of rice bran and soy bean meal.

Molasses feeds, Rothéa (*Ann. Falsif., 15 (1922), Nos. 167–168, pp. 339–353; 169, pp. 408–419; 170, pp. 464–470*).—This is a discussion of the feeding value and materials used in molasses feeds. Such feeds became very popular during the war, but the ingredients used have been so variable that the setting of standards has been difficult, and adulteration has been frequent. The composition of a number of samples are given, together with descriptions of the methods used in making the analyses of the feeds for water, total sugar, reducing sugars, sucrose, ash, total nitrogen, fat, crude cellulose, and nitrogen-free extract other than sugar.

Inspection of feeds, P. S. Burgess and J. B. Smith (*Rhode Island Sta. Ann. Feed. Circ., 1923, pp. 12*).—Following a brief review of the purpose and use of the State feeding stuffs law, the guaranteed and found protein and fat content of the feeding stuffs inspected are given as for the previous year (E. S. R., 47, p. 571).

The packers' encyclopedia, edited by P. I. Aldrich (*Chicago: Natl. Provisioner, 1922, pp. X+445, 521–526, figs. 127*).—This is a handbook of information for the meat packing and allied industries consisting of three parts. In part 1 the methods of slaughtering beef, hogs, sheep, and calves, and curing and manufacturing the products are described. In part 2 live stock and meat statistics for the United States and Canada are given. Part 3 consists of a directory of the meat dealers and packers in the United States and Canada.

The urinary sulphur of fasting steers, T. M. Carpenter (*Jour. Biol. Chem., 55 (1923), No. 2, pp. III, IV*).—Determinations of urinary sulphur on two 600-kg. steers fasting 5, 7, 10, and 14 days were made at the Carnegie Institution at Boston. The minimum and maximum values of the forms of sulphur, calculated by Fiske's method, were inorganic sulphate 0.02 and 2.88 gm., ethereal sulphate 0.05 and 4.23 gm., and neutral sulphur 0.11 and 1.73 gm. The nitrogen: sulphur ratio was fairly constant in all the fasts except in the 7-day fast. Its value averaged about 20:1.

Sheep breeding experiments [at the New Hampshire Station] (*New Hampshire Sta. Bul. 208 (1923), pp. 10, 11*).—A progress report of the genetic study of the Southdown-Rambouillet crossing experiment (E. S. R., 47, p. 473) is given by E. G. Ritzman.

The F_2s and F_3s average smaller than the F_1s, and their conformation is better than the Rambouillets but not so good as the Southdowns. The wool approaches Rambouillet quality in fineness, crimp, and length, but has less grease. Records of the growth weights of lambs indicate that up to 4 or 5 months of age the rate of growth depends primarily on the milk yield of the dam. The Oxford-Rambouillett crosses are being used for a study of the inheritance of fecundity and milk production.

Monograph of the Bündner-Oberländer sheep [of Switzerland], G. Eugster (*Beiträge zur Monographie Bündner-Oberländerschafes. Inaug. Diss., Univ. Bern, 1921, pp. 108, figs. 4*).—This is a study of the origin, history, development, and characteristics of the Bündner-Oberländer sheep. Reports of the sheep in historic and prehistoric times are reviewed, and the different breeds used in their development are discussed from the viewpoint of conformation and quality of the wool and horns. Suggested methods for the improvement of the breed are given.

[Feeding experiments with swine at the Ohio Station] (*Ohio Sta. Bul. 362 (1922), pp. XLVII, XLVIII*).—The following feeding experiments with swine are reported:

Feeding immature corn to swine.—Practically the same amount of moisture-free feed was required to produce 100 lbs. of gain in pigs whether the corn was mature or immature, but the yield of moisture-free corn harvested 1, 2, and 3 weeks before maturity was only 91.7, 82.8 and 56.5 per cent, respectively, of the yield when mature. The loss from turning hogs into immature corn may thus be very high.

Ear corn v. shelled and ground corn for swine.—Hogs fed shelled corn made returns of 2 cts. per bushel, shelled corn which had been ground 8 cts., and shelled corn ground and moistened as a slop 9 cts. per bushel more than hogs fed ear corn. The costs of shelling and grinding, however, are not taken into consideration in calculating these returns.

Minerals and possible substitutes for tankage.—The addition of 2 per cent of finely ground limestone and 0.5 per cent of salt to a ration of corn and linseed meal increased the average daily gains from 0.9 to 1.13 lbs. and reduced the feed consumed per 100 lbs. gain from 426 to 400 lbs., respectively, whereas rice meal, making up 12 per cent of the mixture, increased the daily gain to 1.23 lbs. and reduced the feed consumed per 100 lbs. gain to 377 lbs. Rice meal showed no advantage in rations with tankage or forage crops.

In other lots fish meal was found to be slightly superior to tankage, and when used with linseed meal in proportions of 2 : 1 still greater gains were made, but more feed was required per unit of gain than with fish meal alone. Linseed meal was superior to ground soy beans when fed in a mixture of corn, rice meal, salt, and limestone, but cooked soy beans gave better results than soy beans fed raw. Hydrated lime was an unsatisfactory source of calcium.

How to prevent partial paralysis in swine.—Lameness, rickets, or partial paralysis as occurring in hogs in winter or early spring may be prevented by feeding bright, leafy alfalfa or other legume hay in feeding racks or when chopped in the feed mixture. The addition of steamed bone meal, ground limestone, acid phosphate, and common salt are also recommended.

Fiber in the swine ration.—The importance of a low fiber content of rations for swine is emphasized by the results of experiments in which average daily gains of 1.43 lbs. per head were made by pigs receiving a ration containing 3 per cent of fiber and gains of 1.19 lbs. from a ration containing 9 per cent of fiber. The respective pounds of feed consumed per 100 lbs. of gain in each case were 373 and 452.

Dry land pasture crops for hogs at Huntley, Mont., A. E. SEAMANS (*U. S. Dept. Agr. Bul. 1143 (1923), pp. 24, figs. 3*).—The results of experiments with dry land pasture crops for hogs are reported. These experiments were carried on at Huntley, Mont., from 1915 to 1921 by the Montana Experiment Station, the Office of Western Irrigation Agriculture and the Office of Dry Land Agriculture Investigations, Bureau of Plant Industry, and the Bureau of Animal Industry, U. S. D. A., cooperating.

The crops used consisted of rye, peas, corn, barley, alfalfa, and brome grass, each crop being pastured in 1-acre plats, and the number of pigs pastured, gains made, and the length of time each crop could be pastured were determined. Check plats of the different crops were raised from which the yields of the mature crop were determined. In addition to pasture, the pigs received a daily ration of corn in amounts equivalent to 2 per cent of their live weight. The results of the pasture trials are given for each crop for each year and averaged for the years 1916 to 1921 as shown in the following table:

Average gains produced by hogs on 1-acre plats of different pasture crops.

Crop.	Number of years averaged.	Number of pigs.	Average pasture period.			Average daily gain.	Corn consumed per pound gain.	Yield of check plat.
			Beginning.	End.	Length.			
					Days.	*Lbs.*	*Lbs.*	*Bu.*
Winter rye	6	10.2	May 14	July 4	51	0.58	4.42	10.4
Peas	5	10.2	July 2	July 19	17	1.18	2.83	4.2
Barley	5	10.2	July 22	Aug. 5	14	.35	[1]9.8	8.2
Corn	4	5.5	Sept. 20	Oct. 10	20	1.19	[2]7.44	12.1
Alfalfa (in cultivated rows)	4	5	May 16	July 11	56	.78	2.96	[2]753
Alfalfa (sown broadcast)	4	6.8	...do....	...do....	56	.69	3.25	[2]600
Brome grass (in cultivated rows)	4	5.5	May 11	July 8	58	.61	3.92	.....
Brome grass (sown broadcast)	4	6	...do....	July 5	55	.78	3.11	[2]308

[1] Barley as determined from check plat yield. No corn fed.
[2] Calculated from check plat yield.
[3] Pounds.

Barley proved to be the least satisfactory crop, and work is now being carried on to develop a system of continuous grazing in which the barley will be eliminated or supplemented with green forage which will come later than the peas.

Fattening pigs out of doors, R. G. WHITE and E. J. ROBERTS (*Jour. Min. Agr.* [*Gt. Brit.*], *30 (1923), No. 1, pp. 27–33*).—In a 112-day test at the University College of North Wales the rate and economy of gain made by 11 pigs on pasture was compared with a like number of pigs confined to a pen. The grain ration fed to both lots consisted of 15 parts of coarse middlings, 3 parts of decorticated peanut cake, and 2 parts of fish meal at the start of the test. The amount of fish meal was later reduced and finally discontinued.

At the beginning of the test the pigs averaged 45.7 lbs. in weights and at the conclusion those which had been confined averaged 153.14±2.25 lbs., whereas those which had received pasture averaged 151.55±2.07 lbs. In each lot 499 lbs. of grain were consumed per pig. The confined lot required extra labor for cleaning the sty, but the outdoor lot required fences, which indicates that practically no advantage was shown for either lot.

Hogging down crops (*Ohio Sta. Bul. 362 (1922), p. XXIII*).—The costs and returns per acre from hogging down corn, rye, and clover in 1921 are given in the table below. Tankage supplemented all the crops.

Cost and returns from hogging down crops.

Crop.	Labor.				Seed and fertilizers.	Cost of tankage.	Pork produced.	Gross receipts.	Net receipts.
	Man.	Horse.	Tractor.	Cost.					
	Hours.	*Hours.*	*Hours.*				*Pounds.*		
Corn	22.5	31.0	1.5	$16.70	$2.58	$2.70	711.3	$44.46	$22.48
Corn	20.3	35.3	.8	15.78	2.91	3.00	654.6	45.82	24.13
Rye	7.3	11.0	.....	4.88	4.39	2.54	296.5	28.90	17.09
Clover	5.6	.....	.....	2.01	[1]6.62	1.25	160.8	15.67	5.79

[1] This item includes corn fed.

Though a bushel of rye ground and hand fed will produce more pork than a like amount of rye hogged down, the expenses of cutting, threshing, grinding, and hand feeding are greater. Returns of 83 cts. per bushel of corn when hogged down and 82.5 cts. when husked and hand fed resulted.

Forage crops save protein supplements, J. M. Evvard (*Iowa Sta. Circ. 83 (1923), pp. 8, figs. 2*).—The value of tankage in the ration of pigs is emphasized and a popular discussion is given of the results of feeding experiments on alfalfa and rape pasture, in which it has been found that the forage crops produced gains at a lower cost by requiring less corn, tankage, and supplementary feeds.

Hog production and marketing, E. Z. Russell et al. (*U. S. Dept. Agr. Yearbook 1922, pp. 181–280, figs. 56*).—This is a review of the hog industry in the United States. Among the topics which are briefly considered are the development of the hog industry, origin of the breeds, changes in type, hog production in the Corn Belt and in the South, soft pork, diseases, cost of production, marketing, foreign trade, and the outlook for future hog production.

Finishing pigs for market, A. W. Oliver and E. L. Potter (*Oregon Sta. Bul. 196 (1923), pp. 4–20*).—This is a revised edition of Bulletin 165 (E. S. R., 42, p. 267).

Additional feeding stuffs recommended for finishing pigs are fish meal, garbage, and cull beans; and clover, rape, winter wheat, and vetch and oat pasture. A table showing the relative feeding value of different feed stuffs on a barley basis is also included.

The complete dog book, W. A. Bruette (*Cincinnati: Stewart Kidd Co., 1921, pp. [4]+353, pls. 23*).—General descriptions are given of the different breeds of dogs, which are classified according to their uses. The principles of breeding, training, and caring for dogs are given, with methods of treating the more common diseases.

The book of dogs, L. A. Fuertes and E. H. Baynes (*Washington: Natl. Geogr. Soc., 1919, pp. 96, figs. 72*).—This consists mainly of a description and illustrations of the different breeds of dogs. Articles dealing with the traits and history of dogs, as well as their value to man are included.

Utilization of by-products from hatcheries (*Ohio Sta. Bul. 362 (1922), p. XLV*).—The by-products from hatcheries, consisting of infertile eggs and other eggs which did not hatch, were boiled for one hour, ground, dried, and reground to make a feed containing 35.9 per cent of protein, 21.3 per cent of mineral matter, 39 per cent of fat, and 0.56 per cent of sulphur. In four experiments in which this material was fed to young cockerels, 9 per cent greater gains were produced than with skim milk. It is recommended that the egg material be mixed with the dry mash, but where only small amounts are available the eggs need only be cooked and ground without drying. A suggested mixture for crate fattening market broilers is 40 parts of corn, 20 parts of standard wheat middlings, and 40 parts of moist egg product.

Time required for food to pass through the intestinal tract of fowls, B. F. Kaupp and J. E. Ivey (*Jour. Agr. Research [U. S.], 23 (1923), No. 9, pp. 721–725*).—Previously noted from another source (E. S. R., 48, 75).

Influence of the specific gravity of hens' eggs on fertility, hatching power, and growth of chicks, F. E. Mussehl and D. L. Halbersleben (*Jour. Agr. Research [U. S.], 23 (1923), No. 9, pp. 717–720*).—This is a more complete report of the work previously noted (E. S. R., 47, p. 780).

Perching chicks easily, Mr. and Mrs. G. R. Shoup (*Western Washington Sta. Bimo. Bul., 11 (1923), No. 1, pp. 12–17, figs. 3*).—The desirability of getting young chicks to roost at the age of 31 days is discussed. An explanation is given of the method of teaching chicks to roost early by means of "forced roosts."

Profitable poultry, A. L. Hunt (*Estate Mag., 23 (1923), No. 4, pp. 246 252, figs. 2*).—This is a general discussion of poultry production, with specific refer-

ence to the necessary capital required, construction of houses, raising and feeding young chicks, and care and feeding of laying hens.

How to select the good layers, F. E. Musselil (*Nebr. Agr. Col. Ext. Circ. 1416 (1923), pp. 8, figs. 5*).—Directions for culling the flock by means of physical characteristics and trap nest records are given.

The trap nesting of ducks, C. A. Flatt (*Jour. Min. Agr. [Gt. Brit.], 29 (1923), No. 12, pp. 1114–1119, pl. 1, fig. 1*).—Trap nest records of ducks have been successfully obtained by making single compartments for each duck at night. Ducks have received a place in the National Egg-Laying Contest at Bentley, England, and have made very creditable records.

Goose keeping for feathers and skins (*Jour. Min. Agr. [Gt. Brit.], 30 (1923), No. 1, pp. 70–72, pl. 1*).—This is a review of the methods of breeding, handling, and marketing of geese, their feathers, and their skins in Poitiers, France.

Breeding Angora rabbits for wool (*Jour. Min. Agr. [Gt. Brit.], 30 (1923), No. 1, pp. 68, 69*).—A description is given of this industry in England, with reference to a paper describing Angora rabbit breeding in France (E. S. R., 39, p. 279).

DAIRY FARMING—DAIRYING.

The rate of growth of the dairy cow.—II, Growth in weight after the age of two years, S. Brody, A. C. Ragsdale, and C. W. Turner (*Jour. Gen. Physiol., 5 (1923), No. 4, pp. 445–449, fig. 1*).—The weights of 14,653 Registry of Merit Jerseys are given according to their ages from 2 to 17 years. These data are also presented graphically, and the equation of the course of the monomolecular chemical reaction was fitted to them. The equation used, with substitutions, was

$$X=960\ (1-e^{-0.60(t+0.77)}).$$

X is the weight of the animal at any birth age, *t*, 960 is the weight of the Jersey cow at maturity, and 0.77 year is the length of time that a calf is carried in utero.

"The data show that after the age of 2 years the rate of growth declines in a noncyclic manner. The course of decline in growth follows the course of decline of a monomolecular chemical reaction, that is, the percentage decline in growth with age is constant."

The study of growth to 2 years of age has been noted (E. S. R., 45, p. 378).

Report on stock breeding farms for purebred daily cattle, M. Moore and D. Figgis (*Dublin: Comn. Inquiry into Resources and Indus. Ireland, 1921, pp. 42*).—This consists of the recommendations of the stock breeding farm committee appointed by the Commission of Inquiry into the Resources and Industries of Ireland.[1] The recommendations are for the Government to purchase farms where dairy bulls will be kept for use in improving the dairy cattle in the community.

A comparison of Gold Medal Jersey sires, P. A. Berry and C. W. Turner (*Jersey Bul. and Dairy World, 42 (1923), No. 15, pp. 711, 712, figs. 2*).—The 25 Gold Medal Jersey sires are compared as to the average butter-fat production of their daughters having Registry of Merit records.

Solomon Hoxie, J. L. Hoxie (*New York: Author, 1923, pp. XIV+224, pl. 1*).—This is a review of the life of Solomon Hoxie. Special emphasis is placed on the part he played in developing Holstein-Friesian cattle breeding in America and the beginning of the advanced registry work.

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[1] Ad Interim Report on Milk Production. Dublin: Comn. Inquiry into Resources and Indus. Ireland, 1920, 3. d., pp. 24.

Feeding and management of daily cattle, J. P. LaMaster and C. G. Cushman (*Clemson Agr. Col. S. C., Ext. Bul. 54 (1923), pp. 48, figs. 4*).—This is a general description of the methods of feeding and management of dairy cows, calves, and bulls.

Succulence in the dairy ration, H. E. McNatt (*Western Washington Sta. Bimo. Bul., 11 (1923), No. 1, pp. 6–9*).—A popular discussion is given of the importance of succulent feeds in the rations of dairy cattle.

[Experiments in dairying at the Illinois Station] (*Illinois Sta. Rpt. 1922, p. 20*).—Sunflowers ensiled at an immature stage of development were found to be more palatable, more digestible, and maintained milk production more nearly on a level with corn silage than silage made from more mature sunflowers.

[Experiments with dairy cattle at the Ohio Station] (*Ohio Sta. Bul. 362 (1922), pp. XXXVIII, XXXIX, XL, XLI, figs. 3*).—The results of experiments with dairy cattle are reported.

Wide and narrow rations for dairy cows.—Eleven years' cooperative experiments in feeding dairy cows rations having nutritive ratios of 1:9 and 1:4 have shown no significant difference in the total production, production per unit of digestible nutrients consumed, composition of products, fluctuation in live weight, or breeding record. The cows on the wide ration drank an average of 123.8 lbs. of water per 1,000 lbs. live weight, as compared with 142.4 lbs. of water consumed daily by those on a narrow ration.

Inbreeding in dairy cattle.—Four generations of close inbreeding with dairy cattle have shown no evidence of reduction in fertility, vigor, or production.

Alfalfa v. clover hay for dairy heifers.—Four yearling dairy heifers receiving rations of corn meal and alfalfa hay in proportions of 1:2 by weight made average gains of 189 lbs. in 135 days, as compared with gains of 170 lbs. for a lot receiving clover hay in place of the alfalfa. Measurements of the growth of the different parts of the animals showed respective increases for the two lots as follows: Height at withers 4 and 2.9 in., height at rump 3.2 and 2.3 in., heart girth 6.6 and 4.4 in., and length 11 and 8.8 in.

A feeding test with sweet clover silage (*Ontario Dept. Agr. Bul. 296 (1923), pp. 4–6*).—To compare the feeding value of sweet clover silage and corn silage for milk production, 7 cows were fed for 7 days on a ration of corn silage, mangels, and hay, with a grain mixture of 200 lbs. of bran, 200 lbs. of oats, 50 lbs. of cotton seed, and 75 lbs. of oil meal, followed by a 3 weeks' feeding period in which sweet clover silage replaced the corn silage and another feeding period in which an equal amount of corn silage replaced the sweet clover silage.

During the second and third periods the cows gained 109 and —28 lbs., respectively, in weight and produced 4,427.7 and 4,346.4 lbs. of milk. The average daily consumption of silage ranged from 21.2 to 23.8 lbs. The sweet clover silage consisted of 76.66 per cent water, 4 per cent protein, 1.99 per cent fat, 7.94 per cent fiber, 1.59 per cent ash, and 7.82 per cent carbohydrates. No odors or flavors have resulted in the milk from feeding sweet clover silage to the cows.

[Effect of sweet clover on the milk] (*Ontario Dept. Agr. Bul. 296 (1923), pp. 11–13*).—Experiments to study the effect of sweet clover on the composition and quality of the milk and its products indicated that sweet clover feeding had no influence on the acidity, odor, or flavor of the milk, butter, or cheese.

The rate of decline of milk secretion with the advance of the period of lactation, S. Brody, A. C. Ragsdale, and C. W. Turner (*Jour. Gen. Physiol., 5*

(*1923*), *No. 4, pp. 441–444, fig. 1*).—The average daily milk yields per month during the 12 months of lactation are given for 3,215 Guernseys, 305 Jerseys, 95 Holsteins, and 32 scrubs. The formula expressing a monomolecular chemical reaction is fitted to this data with close agreement. The authors conclude that "this substantiates the idea that milk secretion is limited by a chemical reaction, and in general brings lactation into the class of processes the speed of which is determined by the concentration of a limiting substance." The original data were previously reported (E. S. R., 49, p. 173) by Ragsdale and Turner.

Manual for the dairyman.—Production and commerce in milk, butter, cheese, fruit, vegetables, and eggs, A. Corvez (*Manual du Laitier-Crémier. Lait, Beurre, Fromage, Fruits, Légumes, et Oeufs Production et Commerce. Paris: J. B. Baillière & Son, 1923, pp. 307, figs. 112*).—This is a general book for dairymen dealing with the production and trade in milk, butter, and cheese, imports and exports of dairy products, and dairy management. It contains one chapter on the commerce in fruits, vegetables, and eggs.

A comparison of the cost of a pound of solids in different milk products, P. H. Tracy (*Creamery and Milk Plant Mo., 12 (1923), No. 4, pp. 69, 70, 72*).—The importance of solids-not-fat for ice cream making is discussed, and a method of calculating their cost in the milk products is described, based on the price of skim-milk powder. The calculated costs of fat and milk solids-not-fat in condensed whole and skim milk, skim milk, sweet butter, evaporated milk, and skim-milk powder are given.

Notes on modern dairy chemistry, W. van Dam (*Opstellen over Moderne Zuivelchemie. The Hague: Alg. Nederland. Zuivelbond, 1922, 2. ed., [rev. and enl.], pp. 220, figs. 18*).—This is a revised and enlarged edition of the book previously noted (E. S. R., 37, p. 373).

The vitamin content of milk varies (*Ohio Sta. Bul. 362 (1922), p. XLVI*).—In feeding experiments with rats and guinea pigs the vitamin content of milk from cows on dry feeds was found to be lower than from cows on pasture. The antiscorbutic properties of the milk in particular were greater when the cows were on pasture. The probable destruction of vitamins in hay by sunlight and drying is noted, and it is suggested that the curing of hay be as short as possible with a minimum of exposure to the sun.

Studies on ropiness in cultures of Streptococcus lactis, B. W. Hammer (*Iowa Sta. Research Bul. 74 (1923), pp. 259–270*).—Thirty-six ropy cultures of *S. lactis* from 3 samples of cream were plated on whey agar. From these cultures 1,288 colonies were picked and their ability to produce ropiness in litmus milk determined.

All the platings from 52.8 per cent of the cultures were ropy, whereas only 2.4 per cent of the cultures were nonropy. The others yielded some ropy and some nonropy cultures. In plating out 23 nonropy cultures from two sources only one plating was produced which showed ropiness and that only in 5 per cent of the colonies. No difference between ropy and nonropy cultures could be detected by microscopical examination, but it is suggested that the presence of large numbers of cells is the most probable cause, though the relative differences are small. The development from a ropy colony of a nonropy one which in turn produced a ropy colony occurred in one case. It is concluded that such variations may occur, but there seems to be no particular advantage to the organism in possessing the ropy characteristic.

The practical value of the Skar method of making bacterial counts of milk for sanitary milk inspection, F. Schneider (*Milchw. Zentbl., 52 (1923), No. 3, pp. 25–30*).—The author has compared the bacterial counts of the milk made by the plate method and by microscopical examination, and has concluded that the microscopical method of Skar (E. S. R., 29, p. 206) gives the

best all-round results, since it is rapid and accurate and the morphological differences in the bacteria may be observed.

1916–1919 legislation relative to milk (in the several States), D. H. CURTIS ([*Providence*]: *R. I. State Libr., Leg. Ref. Bur., 1920, pp.* [*10*]).—A review of the laws passed from 1916 to 1919 by the different States relative to the production and handling of milk and other dairy products is given.

Report of the interdepartmental committee on the laws, regulations, and procedure governing the sale of milk in Scotland, W. L. MACKENZIE ET AL. (*Edinburgh: Govt., 1922, pp. 127*).—This is the report of a committee appointed to study the existing laws and regulations under which milk is sold in Scotland, and to suggest additional rules and requirements for maintaining the quality of the milk sold.

Milk plant operation, C. E. CLEMENT (*U. S. Dept. Agr. Bul. 973 (1923), pp. 46, figs. 22*).—The methods of successful management of milk plants are described according to the following operations: Receiving milk at the plant; grading, sampling, and testing; pasteurizing and cooling; bottling and capping; washing bottles; washing cans; sanitation in city milk plants; wastes incurred in handling milk; checking milk through the plant; number of men required to operate milk plants; systems of buying milk; disposal of surplus milk; manufacture of by-products; and weights of milk and cream. Records of the time required and estimated costs of bottling and capping and washing bottles with different types of bottlers, as well as other data which have been taken at various milk plants, are reported.

Quality gelatin, A. D. BURKE (*Ice Cream Rev., 6 (1923), No. 10, pp. 44, 46, 48*).—This is a discussion of the methods of determining the quality of gelatin for ice cream making (E. S. R., 48, p. 773) by the use of the standardizer devised by the author.

VETERINARY MEDICINE.

The care of domestic animals in health and disease, L. STEUERT (*Cuidado de los Animales Agrícolas Sanos y Enfermas. Barcelona: Bustavo Gili, 1921, pp.* [*4*]*+522, figs. 380*).—This work deals with the horse, ox, sheep, goat, swine, poultry, etc.

The animal parasites of domestic and useful animals, J. FIEBIGER (*Die Tierischen Parasiten der Haus- und Nutztiere, Sowie des Menschen. Vienna and Leipzig: Wilhelm Braumüller, 1923, 2. ed., rev. and enl., pp. XVI+439, pl. 1, figs. 353*).—This is a second revised and enlarged edition of the author's handbook on animal parasites (E. S. R., 27, p. 779).

Report of the veterinary director general for the year ended March 31, 1922, F. TORRANCE (*Canada Dept. Agr., Rpt. Vet. Dir. Gen., 1921–22, pp. 48, figs. 6*).—In addition to the usual data on the occurrence of and control work with infectious diseases, a report of the pathological division, etc. (E. S. R., 46, p. 880), this report includes appendixes on Bovine Oidiomycosis, by C. A. Mitchell (pp. 37, 38); Formaldehyde Treated Grain: Is It Injurious for Fowls? by A. B. Wickware (pp. 38–40); Coccidiosis (Red Dysentery) of Cattle in British Columbia, by E. A. Bruce (pp. 40–42); and Pathological Conditions Peculiar to Fowls, by A. B. Wickware (pp. 42–48).

It is pointed out by Bruce that coccidiosis of cattle is chiefly confined to that part of British Columbia known as the dry interior, although it has been known to occur on the Pacific slope, and that it appears to be becoming more prevalent each succeeding year, the mortality in untreated herds reaching as high as 30 per cent.

Report of the territorial veterinarian for the biennial period January 1, 1921, to December 31, 1922, L. N. CASE (*Hawaii Bd. Commrs. Agr. and Forestry [Bien.] Rpt., 1921–22, pp. 82–102*).—This report of the Hawaiian veterinarian includes a discussion of the occurrence of and work with infectious diseases of live stock, particularly bovine tuberculosis.

The coloring of white arsenicals used in stock dipping: Precautions to safeguard life, C. F. JURITZ (*Union So. Africa Dept. Agr. Jour., 6 (1923), No. 3, pp. 253–264*).—This is a somewhat extended discussion of the subject, in which the importance of coloring white arsenicals to avoid fatal accidents is emphasized.

Sympathetic inervation of the muscles of the extremities, E. AGDUHR (*Verhandel. K. Akad. Wetensch. Amsterdam, 2. Sect. 20 (1920), No. 6, pp. 34, pls. 3, figs. 2*).—This is a histo-experimental study which includes a list of 27 references to the literature cited.

Neurotropic ectodermoses—studies on vaccine, C. LEVADITI and S. NICOLAU (*Ann. Inst. Pasteur, 37 (1923), No. 1, pp. 106, pls. 2, figs. 37*).—The authors have demonstrated that the virus of cowpox can be cultivated in the brain of the rabbit and after several exclusively cerebral passages retains its pathogenic properties. In this paper the results are summarized of various investigations conducted on the neurovaccine thus prepared.

Tests of the virulence for various animals of the vaccine when injected either subcutaneously or intracerebrally have shown that it is virulent for rabbits and guinea pigs when injected by either route, for rats, mice, heifers, and monkeys when injected intracutaneously, and for cats when injected intracerebrally. The vaccine had no effect on fowls by whatever route administered. The vaccine was shown to have lost none of its virulence for man when injected cutaneously. A local reaction with no tendency to generalization was the common sequence.

The neurovaccine, when injected into rabbits by various routes, tends to become localized in the skin, particularly where there has been some previous irritation.

A comparison of the properties of the neurovaccine and the dermovaccine has led to the conclusion that the former is more selective in its action and its sensibility toward heat and bile is more marked. A study of the affinity of the neurovaccine for tissues with respect to their embryonic origin has led to the following conclusion: The virus shows an elective affinity for the tissues derived from the ectoderm and for certain organs of endodermic origin, while it has practically no affinity for the blood and the mesodermic tissues. Certain cellular ectoderms require a preliminary irritation to permit entrance and growth of the vaccine. In order for the vaccine to attack any given cellular element this element must have an ecto-endodermic origin and must be in a state of regenerative proliferation or of cell division caused by preliminary irritation. Two theories are advanced concerning the reason for this selective action of the virus. One reason is that it is due to a nuclear hypersensibility created by the irritation of the abrasions, and the other that it is due to a modification of chemical constitution rendering the cellular medium more receptive to the organism.

The neurovaccine produces cutaneous immunity against the dermovaccine and vice versa.

The mechanism of immunity against smallpox, herpes, and encephalitis is as follows: When inoculated into one of the receptive tissue systems (skin, cornea, brain, and testicle) the virus is not content to act purely locally. It passes through the blood or peripheral nerves to the other tissues which attract it by virtue of their specific affinity. Arrived at the sensitive organ, the germ

multiplies and often provokes lesions. When these, passing from an acute to a chronic state, heal, the tissue acquires immunity and becomes insensible to a new infection. This insensibility manifests itself in two ways. On the one hand, the vaccinated organ destroys the virus with a surprising rapidity, and on the other hand it ceases to react on account of characteristic histological alterations to any new attack on the part of the virus. In other words, the virus antigen acts upon each receptive tissue system and creates a local and independent refractory state. Each organ defends itself on its own account and by its own means.

The final point considered was the relationship between contagious epithelioma of fowls and cowpox. Evidence is presented that the dermovaccine inoculated in an epithelial tumor in the crest of a fowl grows and multiplies and lives much longer than when inoculated into a healthy fowl. The neurovaccine is not virulent when inoculated into the crest of a fowl, but recovers its pathogenic properties when associated with the virus of the epithelioma of fowls. When a fowl immunized against the dermovaccine is inoculated with a mixture of the cowpox virus and epithelioma virus, the latter suppresses the refractory state toward the former—that is, the intervention of a pathogenic virus has destroyed the immunity acquired with respect to another virus.

A suggested new method for the disinfection of hides and skins for anthrax, H. F. Smyth and E. F. Pike (*Amer. Jour. Hyg., 3 (1923), No. 3, pp. 224–237*).—Investigations conducted by the authors in the laboratory of hygiene at the University of Pennsylvania have demonstrated (1) the absolute efficacy of iodin as a disinfectant for anthrax, and (2) the possibility of the use of iodin in the tanning industry without the slighest injury to the hides. Two general methods of application are indicated, namely, (1) vapor disinfection and (2) wet disinfection employing water as a solvent, or employing an easily volatile solvent such as carbon tetrachlorid or a carbon tetrachlorid light hydrocarbon mixture.

Tetanus, J. Bagué (*Porto Rico Dept. Agr. and Labor Sta. Circ. 84 (1923), Spanish ed., pp. 5–7*).—A brief popular statement.

Studies on the biochemistry and chemotherapy of tuberculosis.—XXIV. The alimentary absorption of calcium and its deposition in the tissues in experimental tuberculosis, M. E. Mayer and H. G. Wells (*Amer. Rev. Tuberculosis, 7 (1923), No. 1, pp. 1–32, figs. 3*).—Extensive studies are reported on the calcium content of the blood and organs of normal guinea pigs receiving no extra calcium in the diet and of others fed 0.0338 gm. of calcium daily in the form of calcium lactate, of the entire bodies of mice receiving and not receiving calcium, and of the organs of guinea pigs with chronic and with active tuberculosis and receiving or not receiving calcium. A study was also made of the blood changes in the tuberculous guinea pigs under calcium feeding as compared with normal controls.

The individual guinea pigs on the ordinary laboratory diet showed considerable variation in the calcium content of the same tissues. On the average the lowest amount was found in the liver and the highest in the lymph nodes. The addition of calcium lactate to the diet did not increase to a marked extent the amount of calcium recovered from most of the tissues, with the exception of the kidneys which contained a little more, and the lymph nodes considerably more than the normal animals. The increase in calcium in the lymph nodes is attributed to calcium dust in the cages.

No significant differences were noted in the calcium content of the entire bodies (skin and intestines excluded) of mice receiving or not receiving calcium.

In tuberculous animals there was a tendency for the calcium to accumulate in the tuberculous tissues, although the amount deposited did not always vary in proportion to the extent of the tuberculous lesions in the organs. There was less tendency toward calcium accumulation in the lungs than in the spleen, liver, or lymph nodes. The amount of calcium in the lesions was not consistently modified by feeding calcium lactate in addition to the usual diet. No protective or curative effects could be observed in the tuberculous animals fed calcium as compared with those not receiving it. There were no significant differences in the blood of the calcium-fed and control animals.

"These studies, therefore, have failed to produce any experimental evidence which supports the empirical clinical evidence that calcium administration has a favorable influence upon the course of tuberculous infection. They do support the evidence of chemical studies that administration of calcium salts by mouth does not appreciably increase the amount of calcium in the blood and tissues, for this is normally maintained at a level not far below the saturation point of the body fluids."

An attempt to differentiate human and bovine tubercle bacilli by means of the anaphylactic reaction, H. J. Corper and S. Simon (*Amer. Rev. Tuberculosis, 6 (1923), No. 12, pp. 1087–1099*).—Following a review of the literature on the subject, the results are reported of attempts to produce anaphylaxis with living tubercle bacilli in guinea pigs and with living and heat-killed bacilli and tuberculin in guinea pigs sensitized with heat-killed bacilli and tuberculin. All of the primary inoculations were made subcutaneously and all of the second or intoxicating injections intraperitoneally.

In no case were typical acute anaphylactic reactions obtained, and no difference was noted between the reaction of guinea pigs infected with one strain and given the second intraperitoneal injection with the same strain or with any other of the five strains studied. The authors conclude that the anaphylaxis reaction in guinea pigs is not suited to differentiate various strains of human and bovine tubercle bacilli.

Twenty-two years of tuberculin testing in the same herd, A. C. Dahlberg (*New York State Sta. Bul. 496 (1923), pp. 3–8*).—In this bulletin the author reviews the history of tuberculosis in the station herd at Geneva in order to illustrate the success in eradicating the disease and in maintaining a tubercular-free herd. The tuberculin test has been found invaluable in securing and maintaining a tubercular-free herd at the station. While the test has not been perfect, it has been so accurate that by its use a tubercular herd was freed from the disease and a healthy herd maintained for 17 years without one demonstrated case of tuberculosis.

The causal organisms of bovine actinomycosis, T. J. Bosworth (*Jour. Compar. Path. and Ther., 36 (1923), No. 1, pp. 1–22, figs. 7*).—Thirteen out of 34 cases of actinomycosis examined were found to be due to a streptothrix. "The organism which was obtained in pure culture from 8 of these closely resembles the *Streptothrix israëli* first described by Wolff and Israël. Twenty-one of the 34 cases were found to be due to the actinobacillus. Pure cultures which were obtained from 17 of these show the characters ascribed to the organism by Lignières and Spitz."

Experimental abortion in a cow produced by inoculation with Bacterium melitensis, A. C. Evans (*Pub. Health Rpts. [U. S.], 38 (1923), No. 16, pp. 825, 826*).—The author here records an experiment which gives further evidence of the close relationship of the causative organisms of contagious abortion in cattle and of Malta fever in man.

[Infectious abortion in swine] (*Illinois Sta. Rpt. 1922, p. 18*).—It is reported that infectious abortion has been induced in swine by the intravenous

and subcutaneous injection of abortion bacilli and also by feeding abortion bacilli isolated from cases of swine abortion. On the other hand artificially infected sows have not aborted consistently, as shown by the fact that a group of 8 to 12 weeks' old gilts injected subcutaneously with virulent abortion bacilli farrowed normal litters 7 to 9 months later and the bacilli could not be demonstrated in the fetal membranes or in the milk of these animals following farrowing. The milk of some artificially infected sows was found to contain bacilli, but it is considered that the presence of these organisms in the milk does not necessarily produce active abortion infection in the nursing young. It is thought that while there is no definite correlation between a positive agglutination test and abortion, the presence or absence of infectious abortion in the herd may be established with accuracy by the serum agglutination test of all breeding animals.

General mucormycosis in swine, M. CHRISTIANSEN (*K. Vet. og Landbohøjsk. [Copenhagen], Aarsskr. 1922, pp. 133–190, pls. 2, figs. 7*).—This account of studies at the serum laboratory at Copenhagen includes a list of 40 references to the literature cited. Two cases are reported upon, from one of which ***Rhizopus equinus*** C. & L. var. ***annamensis*** Bern. was isolated and ***Absidia ramosa rasti*** Lend. (***Mucor ramosus*** Lindt) from the other.

The anatomy of the horse, a dissection guide, J. M'FADYEAN (*Edinburgh: W. & A. K. Johnston, Ltd., 1922, 3. ed., rev., pp. XX+388, pls. 48, figs. 54*).—In this third edition of the author's guide, which is illustrated by 47 colored plates, the whole of the text has been carefully revised. The several chapters relate, respectively, to dissection of the anterior limb (pp. 1–56), dissection of the posterior limb (pp. 57–95), dissection of the back and thorax (pp. 96–146), dissection of the head and neck (pp. 147–229), dissection of the larynx (pp. 230–238), dissection of the brain or encephalon (pp. 239–263), dissection of the eyeball (pp. 264–274), the ear (pp. 275–281), dissection of the perineum in the male (pp. 282–293), dissection of the abdomen (pp. 294–349), and dissection of the pelvis (pp. 350–377).

Contribution to the morphology of Sarcoptes equi Gerl., F. SCHIKORA (*Ztschr. Infektionskrank. u. Hyg. Haustiere, 23 (1922), Nos. 1, pp. 30–50, pls. 5, fig. 1; 2, pp. 81–103*).—A detailed report of a morphological study by the author, which includes a list of 19 references to the literature.

The toxic doses of potassium arsenite, Fowler's solution, and sodium arsenate for the dog, P. BRU (*Rev. Vét. [Toulouse], 75 (1923), No. 4, pp. 212–215*).—These three medicaments were compared and the toxic dose determined through subcutaneous injections. In the form of potassium arsenite the arsenic is twice as toxic for the dog as in sodium arsenate. The toxic dose limit per kilogram animal weight is 0.006 gm. of potassium arsenite, 10 drops of Fowler's solutioon, and 0.02 gm. of sodium arsenate.

The relation between Bacillus avisepticus types isolated from roup and fowl cholera, L. D. BUSHNELL (*Abs. Bact., 7 (1923), No. 1, pp. 30, 31*).—This is the author's abstract of a paper presented at the annual meeting of the Society of American Bacteriologists held at Detroit in December, 1922. Tests made in an attempt to establish definitely the relation of *B. avisepticus* to roup in chickens made during the summer of 1922 indicate that the *B. avisepticus* isolated from certain cases of roup and chicken cholera are closely related organisms.

The tropical fowl mite (Liponyssus bursa Berl.), R. MATHESON (*Jour. Econ. Ent., 16 (1923), No. 2, pp. 227, 228*).—The author records the presence of this mite at Closter, N. J., and in two poultry yards at Ithaca, N. Y., thus supplementing the information presented by Wood in U. S. D. A. Circular 79 (E. S. R., 42, p. 656).

The pathogenic character of a toxic anaerobe from a spontaneous disease of chickens and ducks, R. GRAHAM and I. B. BOUGHTON (*Abs. Bact., 7 (1923), No. 1, p. 30*).—This is the authors' abstract of a paper presented at the annual meeting of the Society of American Bacteriologists held at Detroit in December, 1922. A syndrome, characterized by leg weakness and prostration and induced in chickens by the anaerobe here described, is said to resemble in some respects type A of *Bacillus botulinus*, although A or B botulinus antitoxins failed to protect against the anaerobe.

Arsenical compounds in the treatment of blackhead in turkeys, E. E. TYZZER (*Jour. Expt. Med., 37 (1923), No. 6, pp. 851–873*).—Investigations show that, while the natural form of blackhead is very fatal to young turkeys, it is favorably influenced by treatment with some of the newer arsenical compounds.

"Neoarsphenamin injected intravenously in toxic doses has a somewhat favorable effect on the course of the spontaneous disease and evidently lowers the mortality. Its instability, its pronounced toxicity for young turkeys, as well as the difficulty of obtaining amounts suitable for the cases to be treated on any one occasion, serve to make its employment impracticable. Less favorable results were obtained with atoxyl. Arsenious acid fed daily in small doses failed to prevent blackhead and possibly increased the incidence of infection. In larger doses it failed to cure spontaneous blackhead. Tryparsamid may be injected in cases of spontaneous blackhead in doses as high as 1 gm. per kilogram of body weight either intravenously or subcutaneously without serious toxic effect. Prompt clinical improvement usually follows, and the mortality is undoubtedly greatly lowered.

"With inoculated blackhead recovery is more difficult to obtain. Birds treated by injections of either neoarsphenamin or atoxyl failed to recover. There were two recoveries among three tryparsamid-treated cases. An attempt to cure inoculated blackhead at an advanced stage by the injection of tryparsamid failed. The study of the lesions of treated turkeys shows that tryparsamid, and to some extent neoarsphenamin, have a more pronounced effect on the liver lesions than on the disease in the lung, which accounts for the discrepancy in the results of the treatment of spontaneous and inoculated blackhead. There is histological evidence of prompt absorption of necrotic liver parenchyma; moreover, the protozoa are destroyed more rapidly in the liver than in the lung.

"Tryparsamid has the most pronounced curative action on blackhead infection of any of the drugs thus far tested. Either intravenous or subcutaneous injection of appropriate doses of this drug at the first appearance of symptoms should serve to cure the majority of cases of blackhead."

Carbon tetrachlorid for fox parasites, F. N. STEELE (*Vet. Med., 18 (1922), No. 5, p. 426*).—The author reports having treated close to 1,000 foxes for hookworm and other parasites with carbon tetrachlorid with good success, there having been a very small loss where no complicating disease was present. Of the last 400 cases treated, where there was no infectious or contagious disease present, only 4 animals succumbed, 2 of these having died of indigestion, 1 from toxemia, and 1 from an undetermined affection. In experimental work 6 cc. of carbon tetrachlorid was administered to a 6-lb. fox without any bad effects, and others received from 3 to 6 cc. without showing any effects different from those to which had been given 1 to 2 cc. With dogs and cats suffering from distemper the loss was found to vary from 10 to 50 per cent no matter how mild the disease appeared to be. The author describes his method of administering carbon tetrachlorid to the fox.

The toxicity of carbon tetrachlorid in relation to liver function as tested by phenoltetrachlorphthalein, P. D. LAMSON and A. J. MCLEAN (*Jour. Phar-*

macol. and Expt. Ther., 21 (1923), No. 4, pp. 237–246, figs. 3).—"The toxic effects of carbon tetrachlorid have been studied by means of the phenoltetrachlorphthalein liver function test. In two cases the effect on renal function has also been studied by means of the phenolsulphonephthalein test. It was found that single doses of 4 cc. per kilogram of carbon tetrachlorid produce functional disturbance of the liver in the dog, with complete return of function to normal within 96 hours. Signs of intoxication in these animals could be observed by this method before any visible signs or symptoms were evident. The kidneys did not appear to be affected by this dose. Administration of 2 cc. per kilogram produced no demonstrable disturbance in either liver or kidney function. Finally, 4 cc. per kilogram (the found toxic dose), given in divided doses of 2 cc. per kilogram at 48 hour intervals, were found to have no toxic effect, which is contrary to the belief that divided doses are more toxic than a single massive dose." A list is given of 17 references to the literature.

RURAL ENGINEERING.

Twenty-first biennial report of the State engineer to the Governor of Colorado, A. J. McCune (*Colo. State Engin. Bien. Rpt., 21 (1921–22), pp. 256, pl. 1*).—This report deals with the operations of the office of the State engineer of Colorado for the biennium ended November 30, 1922. It contains, among other things, sections on the operation of irrigation districts, floods, and earth dam failures.

Second biennial report of the Department of Reclamation, State of Idaho, 1921–1922, W. G. Swendsen et al. (*Idaho State Dept. Reclam. Bien. Rpt., 2 (1921–22), pp. 251*).—The activities and expenditures of the Department of Reclamation of the State of Idaho for the biennium 1921–1922 are described in this report. These include studies of water resources involving measurements of stream flow and work on the formation of irrigation districts.

Surface water supply of St. Lawrence River Basin, 1919–1920 (*U. S. Geol. Survey, Water-Supply Paper 504 (1923), pp. IV+188, pls. 2*).—This report, prepared in cooperation with the States of Wisconsin, New York, and Vermont, contains the results of measurements of flow made on streams tributary to the Great Lakes and St. Lawrence River during the years ended September 30, 1919, and 1920.

The floods in central Texas in September, 1921, C. E. Ellsworth (*U. S. Geol. Survey, Water-Supply Paper 488 (1923), pp. IV+56, pls. 8, figs. 5*).—This report, prepared in cooperation with the State of Texas, presents information and detailed data on the nature and extent of the floods in central Texas during September, 1921, and a review of the damage caused. Flood flow data are included.

Routes to desert watering places in the lower Gila region, Ariz., C. P. Ross (*U. S. Geol. Survey, Water-Supply Paper 490–C (1922), pp. IV+4+271–315, pls. 7, fig. 1*).—Data and maps indicating the routes to the desert watering places in the lower Gila region in Arizona are presented in this report.

Routes to desert watering places in the Papago country, Ariz., K. Bryan (*U. S. Geol. Survey, Water-Supply Paper 490–D (1922), pp. VI+4+317–429, pls. 10, fig. 1*).—Data and maps indicating the routes to the desert watering places in the Papago country in Arizona are presented in this report.

Hydroelectric power systems of California and their extensions into Oregon and Nevada, F. H. Fowler (*U. S. Geol. Survey, Water-Supply Paper 493 (1923), pp. XLIX+1276, pls. 73, figs. 50*).—This report, prepared in cooperation with the U. S. D. A. Forest Service, comprises available information

on the history, markets, electric systems, finances, and rates of each of the operating hydroelectric companies in California, and outlines the general conditions under which they have attained their present stage of development. A large amount of engineering and economic data is included.

Economics of land drainage projects, D. L. McLean (*Engin. and Contract., Water Works, 59 (1923), No. 4, pp. 858, 859, figs. 2*).—Two methods of analyzing land drainage benefits are briefly described. The first considers the effect of crop losses, occurring with average frequencies, on the productive value of agricultural land. The second method has for its purpose the direct determination of the extent of the crop loss and its use as a measure for guidance in determining the benefits to be derived from a particular project.

Benefits of drainage, H. B. Roe (*Minn. Agr. Ext. Spec. Bul. 67 (1923), pp. 20, figs. 16*).—Popular information as to the benefits to be derived from soil drainage, with particular reference to conditions in Minnesota, is presented in this bulletin.

Surveying for settlers, W. Crosley (*London: Crosby, Lockwood & Son. 1922, pp. XII+159, pls. 3, figs. 59*).—This is a simplified handbook of surveying for the use of pioneers, farmers, planters, and others settling in new countries.

Report of the California Highway Commission (*Calif. Highway Comn. Bien. Rpt. 1921–22, pp. 214, pls. 3, figs. 100*).—This report contains an account of the activities and expenditures of the California Highway Commission during the years 1921–1922.

Among other experimental data a report is presented of tests of motor lubricating oils used in motor trucks, by T. E. Stanton. Two paraffin base oils and an asphalt base oil were used in the tests. The results did not indicate any appreciable superiority of one grade over another. Although thinning out more rapidly, the asphaltic base oil did not show any greater breaking down under high working temperatures than the paraffin base oil, nor was there a greater deposit of carbon. The viscosity after use did not increase or decrease any more in the case of one oil than in the case of another. There appeared to be some practical advantages in the use of the paraffin base oil where one grade of oil is to be used all seasons of the year and under a wide range of temperature, since for normal temperatures above 40° F. this oil was less stiff than an asphaltic base oil of the same viscosity. There appeared to be no reason, however, why a lighter grade of asphaltic base oil can not be used in cold weather than in hot weather.

A new impact strain gauge, E. B. Smith (*Engin. and Contract., Roads and Streets, 59 (1923), No. 4, pp. 759–761, figs. 7*).—An instrument based upon principles of optical levers for measuring deformations resulting from suddenly applied forces and impact is described and illustrated, which has been developed by the U. S. D. A. Bureau of Public Roads.

Stone screenings as fine aggregate for concrete, D. A. Abrams (*Concrete [Detroit], 22 (1923), No. 4, pp. 128–132, figs. 4*).—Studies conducted at the Lewis Institute on the use of stone screenings as fine aggregate for concrete are reported. These showed that aggregate testing has not thus far reached the state of an exact science, and that available test methods do not permit the definite determination of the relative merits of aggregates of different types.

Mortar strength tests are likely to give misleading results, particularly when tension tests are made on briquets. The strength of concrete made from screenings on the same basis was found to be a little lower than the strength of concrete made from natural sands.

It is concluded that good concrete can be made with stone screenings as fine aggregate, but that proper grading, to eradicate an excess of dust and

extremely coarse particles, and the use of not too much water are important factors. It was found that, due to the angularity of the particles, there is a tendency with screenings to use more mixing water than is required by sands.

Use of calcium chlorid as a protection against freezing of concrete, P. COTTRINGER and H. S. KENDALL (*Concrete [Detroit], 22 (1923), No. 4, p. 150–155, figs. 7*).—Studies are reported which showed that calcium chlorid when used in proper amounts is very beneficial to concrete that will be exposed to cold-weather conditions. A gradual increase in strength was observed with increases in the amounts of calcium chlorid used at various temperatures up to a maximum of 6 per cent. This is taken to indicate the fallacy of a rule which will give definite temperatures at which concrete may be protected from freezing. It was found that 2 per cent calcium chlorid was better than none at any temperature below 32°F., 4 per cent was better than 2 per cent, and the benefit increased up to a maximum of 6 per cent. A mixture containing 2 per cent calcium chlorid was indicated for normal conditions of curing, while 6 per cent was indicated for cold weather.

Calcium chlorid did not keep the concrete from freezing at any temperature lower than the freezing point of the solution used. It had a beneficial effect even at freezing temperatures, however, the strength with a 6 per cent mixture being in some cases ten times that obtained when no calcium chlorid was used. Amounts of calcium chlorid in excess of 6 per cent, while beneficial at very low temperatures at earlier ages of the concrete, did not give as good results as a 6 per cent mixture at later ages.

This material was found to protect concrete at lower temperatures under alternate low and high temperature conditions than under conditions of continuous low temperature. No additional corrosion of reinforcing steel was found when calcium chlorid was used.

Moisture resistant coatings for wood (*Engin. News-Rec., 90 (1923), No. 14, p. 613*).—The progress results of a series of tests being conducted by the U. S. D. A. Forest Service to determine the protection against moisture afforded by various coatings are briefly presented.

Linseed oil was found to be quite ineffective in the absorption tests, and five coats of hot oil followed by two coats of floor wax failed to give any great protection. Oil paints were found to form a film over wood which was very durable even in exterior locations. The laboratory tests showed, however, that such a film, although it may be continuous, does not prevent moisture changes in wood. Graphite paints and spar varnish were about as effective as the ordinary oil paints with the heavier pigments. Cellulose lacquers ranked somewhat higher than the foregoing materials in moisture resistance, and it is thought that they can be considerably improved by the addition of solids, since they are fast drying and form elastic films.

Rubbing varnishes afforded considerably more protection against moisture than spar or long oil varnishes, which is attributed to the larger amounts of gum solids present in the rubbing varnishes. A heavy coat of paraffin or enamel coatings made by the addition of pigments such as barytes to ordinary varnish were about as effective as rubbing varnishes.

A bronze coating composed of a cheap gloss oil and aluminum powder proved to be superior in moisture resistance to any of the coatings mentioned above. This mixture was very fast drying, permitting the application of three coats within half an hour. An aluminum-leaf coating was also highly efficient in preventing moisture changes in wood. For temporary protection against moisture changes, vaseline smeared over varnish is said to be one of the most moisture resistant coatings yet tested.

Kiln drying handbook, R. THELEN (*U. S. Dept. Agr. Bul. 1136 (1923), pp. 64, pls. 12, figs. 12*).—This bulletin presents, in condensed and convenient form for the special use of the dry-kiln operator the fundamental facts regarding the drying of wood. The major portion deals with the kiln drying of lumber, but specific suggestions are also included concerning the drying of other forms of wood. The general information is said to be applicable to all kinds of drying. The data are for the most part based upon extensive investigations by the Forest Products Laboratory of the Forest Service.

The effects of waterproofing materials and outdoor exposure upon the tensile strength of cotton yarn, H. P. HOLMAN and T. D. JARRELL (*Indus. and Engin. Chem., 15 (1923), No. 3, pp. 236–240, fig. 1*).—Experiments conducted by the U. S. D. A. Bureau of Chemistry are reported, in which unbleached and unsized warp yarn was treated with various waterproofing materials and exposed to the weather to show the effects on tensile strength. These experiments were apparently made in connection with investigations on the value of various materials for waterproofing and mildew-proofing fabrics for farm and other uses.

The treated yarns in most cases showed less deterioration in tensile strength than did the untreated yarns. The bituminous materials as a class, with the exception of pine tar, were among the best waterproofing materials with respect to the effect on tensile strength. Yarns subjected to three laboratory treatments containing asphalt in combination with other products not only showed a higher tensile strength than the untreated yarn after exposure, but were practically as strong after one year's exposure as directly after treating.

Raw drying oils had a greater deteriorating effect than the same oils boiled with metallic driers or partially oxidized by other means. Semidrying and nondrying oils, with the exception of mineral oil, caused as much or more deterioration than the raw drying oils. When burnt umber was added to a drying oil treatment, the treated yarn was much stronger after exposure than yarn subjected to the same treatment without burnt umber and similarly exposed. Rosin and rosin oils caused a decided reduction in tensile strength after exposure. Treatment with rubber solution followed by cold vulcanization with fumes of sulphur monochlorid caused immediate and marked deterioration in tensile strength. Oleic acid caused greater deterioration than other fatty acids used, including palmitic and stearic acids and the fatty acids from linseed oil. Lead oleate had a greater deteriorating effect upon tensile strength than copper oleate.

The rate of deterioration of treated yarns exposed to the weather was greatest during the hottest season of the year, indicating that significant information on the deteriorating or protective effects of treatments on cotton textiles could probably be obtained by exposure for six months in hot weather. The results obtained with yarn are said to be not strictly applicable to woven fabrics.

Motor transport performance with varied fuel volatility, C. T. COLEMAN (*Jour. Soc. Automotive Engin., 12 (1923), No. 4, pp. 343–350, figs. 9*).—Data obtained by the U. S. Bureau of Standards are presented on the economic operation of a fleet of motor vehicles with fuels of varied volatility under service conditions.

It is stated that, while the results may not hold true for cold-weather operation, they show that the number of car miles per barrel of crude oil increases as the volatility of the fuel decreases over the range of fuels used. This is said to be true because the percentage of production per barrel of crude oil is increased, while the number of car miles per gallon of fuel is not affected materially by the variation in the volatility as represented by the fuels used.

Engine experiments with oxidized oils, J. H. JAMES and F. C. ZEISENHEIM (*Chem. and Metall. Engin., 28 (1923), No. 12, pp. 543–545*).—Experiments conducted at the Carnegie Institute of Technology with a farm internal-combustion engine, using a fuel made by the catalytic oxidation of kerosene and a fuel of similar character made by the oxidation of gas oil, are reported.

The results showed that the oxidized kerosenes, which have a lower boiling range than the raw materials, develop approximately the same power as ordinary kerosene, in spite of the fact that their thermal value is one-eighth less. It is believed that there is a more thorough clean-up in the combustion of these partly oxidized fuels, which accounts for their efficiency. The oxidized kerosenes showed lower detonation tendencies than the straight hydrocarbon fuel. Similar experiments with lower boiling oxidized fuels in an automobile engine gave confirmatory results.

The utilization of molasses in the manufacture of motor fuel, H. ARNSTEIN (*La. Planter, 68 (1922), Nos. 22, pp. 350–352; 23, pp. 369, 370, fig. 1*).—Considerable information is summarized on the manufacture of alcohol motor fuel from waste molasses, apparently employing the usual process of treating the alcohol with ether obtained by dehydration of alcohol with sulphuric acid. Information is also summarized on the use of this fuel in internal-combustion engines.

Friction testing of lubricating oils, W. H. HERSCHEL (*Chem. and Metall. Engin., 28 (1923), No. 13, pp. 594–598, figs. 7*).—The results of investigations at the U. S. Bureau of Standards on the measurement of oiliness of lubricants with a friction testing machine are reported. The conclusion is drawn that there is little probability that a journal friction testing machine will ever prove convenient for testing oiliness, because the clearance changes with wear. No experimental evidence was obtained that the value of Sommerfield's criterion at the point of minimum friction varies with the oiliness.

Laws governing gaseous detonation, T. MIDGLEY, JR., and R. JANEWAY (*Jour. Soc. Automotive Engin., 12 (1923), No. 4, pp. 367–373, figs. 12*).—An explanation of gaseous detonation, based upon what are considered to be incontrovertible laws, is presented in this paper, and it is shown that by the functioning of these well understood natural laws gaseous detonation is a phenomenon that does not require any hypothetical assumptions to account for its existence. The physical conditions that must exist within an inclosed container when it is filled with an explosive mixture of gases and these gases are ignited are stated and analyzed mathematically, and an application of this analysis is made to the internal-combustion engine for constant throttle and varying temperature of entering charge and for constant temperature and varying throttle opening and compression ratio.

Collection and examination of explosive dusts in air, L. J. TROSTEL and H. W. FREVERT (*Indus. and Engin. Chem., 15 (1923), No. 3, pp. 232–236, figs. 3*).—In a contribution from the U. S. D. A. Bureau of Chemistry the results of a study of the paper filter principle, with some special adaptations for its applicability to the collection and examination of explosive dusts in air are reported. The scheme used consisted of filtering a measured volume of dusty air through a paper thimble by either a calibrated hand pump or a small, portable, electrically driven blower equipped with a Venturi meter and manometer. This permitted the collection of data on solids per cubic foot of air, particle size and composition, and in heavy samples the relative flammability.

The optical filtering efficiency against tobacco smoke was found to be 46.2 per cent and that against air-floated silica dust 100 per cent, after an aver-

age initial lag of 37 seconds. The gravimetric filtering efficiency against starch dust was 99.5 per cent. The absorption of moisture by the paper filter during sampling in atmospheres with a relative humidity as high as 90 per cent did not affect the rate of flow of air through the thimble. This apparatus is said to furnish data which are consistent with the law governing the rate of fall of dusts.

Deep plowing, ordinary plowing, and subsoiling (*Ohio Sta. Bul. 362 (1922), pp. X, XI*).—Experiments begun in 1909 to compare ordinary 7.5-in. plowing with 15-in., and with ordinary plowing followed furrow by furrow with a subsoil plow run to a depth approximately that reached by the 15-in. plow, are briefly reported, showing that the 7.5-in plowing is by far the most profitable.

Plans and specifications for New Jersey poultry houses, W. C. THOMPSON, W. P. THORP, JR., and G. H. POUND (*New Jersey Stas. Circ. 152 (1923), pp. 16, figs. 13*).—This circular contains drawings, specifications, and bills of material for the improved multiple unit laying house and the New Jersey suburban unit house.

Wind pressure in chimney design, W. W. CHRISTIE (*Power, 57 (1923), No. 12, pp. 438, 439*).—Formulas for the determination of wind pressure in the design of chimneys are compared, and tabular data on wind velocity and base pressure are presented and discussed.

Recirculation driers, E. H. WIEGAND (*Oregon Sta. Circ. 40 (1923), pp. 3–11, figs. 6*).—The principles involved in the drying of prunes by the recirculation of heated air and the construction and operation of a type of recirculation drier designed by the station are described in this circular.

RURAL ECONOMICS AND SOCIOLOGY.

Agricultural tribunal of investigation.—Interim report, W. J. ASHLEY ET AL. (*London: Govt., 1923, pp. 11+12*).—This group was appointed December 29, 1922, to inquire into methods which had been adopted in other countries during the last 50 years to increase the prosperity of agriculture and to secure the fullest possible use of the land for the production of food and the employment of labor at a living wage, and to advise as to the methods by which those results could be achieved in England and Wales.

Consideration is given in the interim report to methods of cooperation among farmers and to the development of agricultural education. It is deemed important to extend research in the direction of testing new systems of farm managment, particularly as regards the maintenance of live stock on arable land.

It is recommended that the Government subsidize the railways to the extent of 25 per cent of the present freight rates on fertilizers, feeding stuffs, seeds, and machinery, and on agricultural produce. It is proposed that rates of taxation on agricultural land should be reduced, that importers of wheat flour should be required to send 25 per cent of wheat offals to 75 per cent of flour and that the feeding stuffs thus obtained should be retained in the country by the imposition of a 10 per cent ad valorem duty on exports, and that a duty of 10s. per quarter be imposed upon imports of malting barley and of 20s. per hundredweight on hops, while a ban should be placed on potatoes to be lifted only by a license issued by the president of the board of trade allowing such importation. It is urged that the growing of sugar beets be encouraged by the exemption of home-grown sugar from excise duty, and finally that imported agricultural produce be marked with its country of origin. Other recommendations are made with reference to the importation

of milk and cream, dry milk, and other milk products; agricultural wages, recommending the establishment of about six district wages boards to cover the whole of England and Wales, each having executive powers within their own areas and uncontrolled by any central board, and emphasizing the opinion that they should confine themselves to the enactment of minimum wages and the granting of permits of exemption without fixing in effect the actual rates of pay; relief of rural unemployment; and local administrative machinery.

Food, C. FIELDING (*London: Hurst & Blackett, Ltd., 1923, pp. XI+255. pl. 1*).—This is a statement of the case for home food production in England. There is discussion of questions of increasing the output by improved methods of cultivation and improved fertility and of the advantages of breaking up grassland. The possibility of increasing the arable areas is discussed for specific counties and the extent to which the yields of specific crops may be increased is set forth. The home production of beet sugar is particularly urged.

The author is opposed to land nationalization in principle and on the ground that the only person who would benefit would be the farmer and that only to the extent of 1s. 4d. an acre in rent. It is held that there is room in British agriculture for the employment of several millions of additional workers if a supply of raw materials for industry is to be produced at home.

Land nationalization, A. E. DAVIES and D. EVANS (*London: Leonard Parsons, 1921, pp. 159*).—Tentative suggestions are offered for a policy of land nationalization including State ownership of minerals. It is assumed that the community must pay for the land when it is taken, and a national land bond issue is recommended. Land settlement schemes in various countries are briefly described.

Investigations relative to the profits from Swiss agriculture for the crop year 1921–22, E. LAUR ET AL. (*Landw. Jahrb. Schweiz, 37 (1923), No. 1, pp. 101*).—This annual report is presented in continuation of a series previously noted (E. S. R., 47, p. 691).

The agriculture in the Saar region, R. CAPOT-REY (*Ann. Géogr., 32 (1923), No. 176, pp. 97–118*).—This region in western Germany is characterized as one where very small agricultural holdings prevail and where wheat production is a minor industry and uncertain. Potatoes are the leading crop, and farm animals few.

Proceedings and papers presented at the Congress of Colonial Production (*Cong. Prod. Colon. [Marseille], 1922, Compt. Rend. et Raps., Textiles [etc.], pp. [3]+287, pls. 3*).—The papers incorporated here are concerned with the present and potential production of industrial raw material, sugar, medicinal plants and perfumes, and live stock in the French colonies.

Agricultural colonies and tenancy copartnership societies in Burma (*Madras Bul. Coop., 14 (1922), No. 6, pp. 193–195*).—This is a brief note concerning the methods of allotment of land and the securing of loans to members of the societies for the purpose of cultivating land.

Oats, barley, rye, rice, grain sorghums, seed flax, and buckwheat, C. R. BALL ET AL. (*U. S. Dept. Agr. Yearbook 1922, pp. 469–568, figs. 64*).—This is a statistical study, illustrated largely with graphs and dot maps, pointing out for each of the crops mentioned its region of production in the United States and trends from an historical point of view, the natural factors influencing its production, marketing, the present situation, and future outlook. Costs of production are noted briefly, and a discussion is given of the position of corn, wheat, hay, cotton, and the crops mentioned above in American agriculture.

The dairy industry, C. W. LARSON ET AL. (*U. S. Dept. Agr. Yearbook 1922, pp. 281–394, figs. 80*).—This economic and statistical study of the industry is presented in sections on the consumption and utilization of dairy products, the geography of production, the development of dairying in the United States, the production of dairy cattle, legal control of dairy products, meat production from dairy live stock, tuberculosis and the cattle tick as limiting factors in the industry, the cost of milk production, marketing dairy products, prices, and the tariff and export trade.

Weather, Crops, and Markets (*U. S. Dept. Agr., Weather, Crops, and Markets, 3 (1923), Nos. 18, pp. 417–440, figs. 2; 19, pp. 441–480, figs. 12; 20, pp. 481–504, figs. 2; 21, pp. 505–528, figs. 2*).—Temperature and precipitation charts for the weeks ended May 1, 8, 15, and 22, 1923, are presented in these numbers with general and weekly summaries of weather conditions. There appear also the usual weekly and monthly reports, summaries, and special articles setting forth the receipts and prices of important classes of crops and live stock and the position in the market of specific commodities. The crop report given in No. 19 is made up of the crop summary for May and a report on condition of farm animals, together with the usual farm value tables, reports upon the acreage and condition of particular crops, and an article illustrated with five charts indicating the trend of corn prices between 1870 and 1923 and comparing production with corn prices, acreage, yields, and value of crops, as well as corn prices and the value of the crop.

Bankers' advances against produce, A. WILLIAMS (*London and New York: Isaac Pitman & Sons, Ltd., 1921, pp. VII+148*).—The first chapter of this volume, prepared by a banker of Liverpool, describes the financing of produce from the time it is shipped to Great Britain up to its sale to the British consumer. In subsequent chapters documents of title, forms of lien and pledge, and questions of the storage, insurance, and marketability of different kinds of produce are dealt with.

Pastoral life in the French Alps.—A study in human geography, P. ARBOS (*La Vie Pastorale dans les Alpes Françaises. Étude de Géographie Humaine. Paris: Armand Colin, [1923], pp. [2]+716+[4], pls. 16, figs. 52*).—This is an exhaustive study of methods of property holding, the evolution of special communal societies, and laws and customs relating to the use of pasturage, haying, living and agricultural conditions, means of communication, and the way in which the industries of the French Alps have developed as a result of environmental influences. The history of the live stock industry and the commerce in live stock products is traced from the Middle Ages to the present. The effects upon this region of the economic crisis of the nineteenth century and of the agricultural revolution which followed it are traced in detail. Certain regions are differentiated according to whether the small live stock, such as sheep, are more numerous or cattle predominate.

The Alps are said to have been characterized up to the eighteenth century by a combination of agriculture and live stock raising. The lack of easy communications made necessary a self-sufficing economy, but the climatic conditions rendered agriculture precarious. The beginning of the nineteenth century marked by an increase in population aggravated the situation, and the mountainous regions could only with the greatest difficulty support both men and animals. The agricultural revolution almost universally resulted in an increase in the number of cattle at the expense of that of sheep. In the Alps of the North sheep have practically disappeared. The dairy industry has developed universally.

The pastoral life of the French Alps is made up of three types, that predominating in Savoy, that of the southern grassy Alps, and that of the Alps in

Provence, and each of these is described in detail. The history and development of the custom of summer grazing or of driving the flocks from the higher pastures to the lowlands of Italy for feeding during the winter time (transhumance) are set forth. The last one of the four books is devoted to an account of the permanent and temporary dwellings, villages, and roads of this region and of the commerce in animals and in dairy products.

The evolution of the country community, W. H. WILSON (*Boston: Pilgrim Press, 1923, 2. ed., enl. and rev., pp. XV+259, fig. 1*).—This is the second edition of a volume noted earlier (E. S. R., 28, p. 687), which has been enlarged and thoroughly revised.

The farmer and his community, D. SANDERSON (*New York: Harcourt, Brace & Co., 1922, pp. IX+254*).—The definition which is arrived at here is that a rural community consists of the people in a local area tributary to the center of their common interests.

A summary of the author's study of rural community activities with reference to the economic, social, and religious life of the farming population is given in 19 chapters.

The modern farm cooperative movement, C. C. SHERLOCK (*Des Moines, Iowa: Homestead Co., 1922, pp. [9]+377, figs. 16*).—An account is presented in 21 chapters of the origin of the farmers' cooperative movement and recent developments away from the purely local unit character toward federation.

Cooperative laundries in the United States, R. VAN DEMAN (*Jour. Home Econ., 15 (1923), No. 5, pp. 252–258*).—Five cooperative laundries, 2 of which were rural laundries operated in conjunction with cooperative creameries, 2 organized primarily to regulate the wages and conditions of the workers, and 1 an experiment started in Greenwich Village, New York City, are briefly noted. It is concluded that for several specific reasons the rural community would seem to be the place where the cooperative laundry is most likely to succeed. Suggestions are made with reference to the survey preliminary to organizing such a laundry, the pledging of patronage, and management.

[Yearbook statistics of crops and live stock production and trade] (*U. S. Dept. Agr. Yearbook 1922, pp. 569–1078*).—Continuing previous data (E. S. R., 48, p. 294) U. S. Department of Agriculture statistics of acreage and production and prices of grain crops; crops other than grains; farm animals and live stock products in the United States and in foreign countries, 1922, with summaries for earlier years; and forest statistics are tabulated. Compilations are also given of statistics of exports and imports of agricultural products, miscellaneous statistics including among other items crop summaries, harvesting and planting dates, prices of things farmers buy, wages of farm labor, and agricultural statistics from the census of 1920. There are included statements showing freight rate changes through a number of years, farm equipment manufactured in the United States, and the normal day's work for various operations in the production of the more important crops.

Summary of statistics of agricultural exports and imports to be considered in adjusting agricultural production to foreign demand (*U. S. Dept. Agr., Bur. Agr. Econ., 1923, pp. [4]+42*).—This is a mimeographed report summarizing statistics noted above.

Crop and live stock estimates, 1910–1922 (*U. S. Dept. Agr., Misc. Circ. 6 (1923), pp. 30*).—This comprises statistics of area, average yield, and production compiled in the Bureau of Agricultural Economics, and of exports and imports of crops and live stock for the United States from the Bureau of Foreign and Domestic Commerce, U. S. Department of Commerce, together with miscellaneous statistical items.

Arizona crop and live stock report, July, 1922 (*Ariz. Indus. Cong. Bul. 19 (1922), pp. 12*).—Data are presented in short tables and commented upon in this report, prepared cooperatively by the Bureau of Agricultural Economics, U. S. D. A., and Arizona State agricultural agencies.

Agricultural statistics of the State of Colorado, 1922 (*Denver: State Bd. Immig., 1923, pp. 63, figs. 24*).—Agricultural statistics are presented which were collected by the assessors of the several counties in the State for the State Board of Immigration and compiled under the direction of the statistician of the board, in some cases in cooperation with a representative of the Bureau of Agricultural Economics, U. S. D. A. Maps and charts are included.

Crop and live stock summary, State of Connecticut, 1921–1922 [*Hartford*]: *Conn. State Bd. Agr.* [*1923*], *pp.* [*8*]).—Tables and summary comment set forth the conditions and acreage of the principal crops of the State and the number and value of live stock there. The information was obtained cooperatively by the Bureau of Agricultural Economics, U. S. D. A., and the Connecticut State Board of Agriculture.

Synopsis of the census of September 1, 1920.—Live stock, B. Carvalhoz (*Synopse do Recenseamento Realizado em 1 de Setembro de 1920. População Pecuaria Numero de Animaes das Varias Especies de Gado. Rio de Janeiro: Min. Agr., Indus. e Com., Dir. Geral Estatis., 1922, pp. 51*).—Returns showing the number of farm animals in Brazil in 1920 are tabulated by classes of live stock and for political divisions of the country.

[Statistics of production for New Zealand, 1919–1920], M. Fraser (*New Zeal. Statis., 3 (1919), pp. 1–132; 3 (1920), pp. 1–134*).—Annual statistics for the later years are added to a series of reports previously noted (E. S. R., 43, p. 491).

Source book of research data, L. H. Haney and C. C. Meyer (*New York: Prentice-Hall, Inc., 1923, pp. XI+70*).—This is an analytical list of current statistical data on the quantity and price of important commodities prepared by the Bureau of Business Research of the New York University. An index is given of the chief agencies which compile business data and some of the more important publications recommended for any business research library.

Tables for the conversion of the principal measures used in agriculture in Brazil into the metric decimal system, A. C. A. de Gusmão (*Tabellas de Conversão das Principaes Medidas Agrarias Usadas no Brazil em Unidades do Systema Metrico Decimal. Rio de Janeiro: Min. Agr., Indus. e Com., Dir. Geral Estatis., 1921, pp. IX+104+3*).—These tables are presented for use in connection with statistics taken in the census of 1920 for Brazil.

AGRICULTURAL EDUCATION.

Some fundamentals of agricultural education, H. J. Wheeler (*School and Soc., 17 (1923), No. 424, pp. 141–148*).—Some of the requisites of teaching in agriculture set forth here are that the student be trained in independent thinking, led to assume initiative in investigation, trained to take into account the cost of the industry and the solution of the cost problems, and given an appreciation of research as such, initial perspective and broad historical and scientific background, and knowledge of ordinary business transactions, as well as thoroughly up-to-date reliable information on agricultural subjects.

The relation of agricultural education to farm organization, C. W. Pugsley (*U. S. Dept. Agr., Misc. Circ. 3 (1923), pp. 19*).—In this address before the annual meeting of the American Farm Bureau Federation at Chicago, December 14, 1922, it is held that any system of agricultural education must take into consideration the economic distribution of farm products, and that the

teacher must have suggestions for the farm home, the rural school, and community activities as well. It is also suggested that the time has come when colleges of agriculture should give a complete college course designed to prepare cooperative managers. Farm organizations are urged to maintain close association with public investigational and educational institutions. It is pointed out that the extension system is primarily an educational one, and that close contact between extension agents and farmers' organizations is deemed vital to the success of the county agent system.

The functions of the county agent, with particular reference to cooperation with farmers' organizations, are outlined. The memorandum of understanding between the executive committee of the American Farm Bureau Federation and the States Relations Service, U. S. D. A., relative to farm bureaus and extension service, as well as a statement of the Secretary of Agriculture concerning the relation of Federal cooperative extension employees to agricultural organizations and a resolution of the Association of Land Grant Colleges with reference to the scope of extension work in agriculture and home economics, are included in full.

The development of agricultural education in England and Wales, A. D Hall (*Jour. Roy. Agr. Soc. England, 83 (1922), pp. 15–34*).—Until the close of the eighties in the nineteenth century the only systematic courses of instruction in agriculture offered in England and Wales were at the Royal Agricultural College of Cirencester, founded in 1845, a private college at Downton, and a similar one started at Aspatria in 1878. No State assistance was available for agriculture until in 1884 the newly founded University College of North Wales at Bangor began to include agricultural science in its curriculum, and the Technical Instruction Act of 1888 gave powers to local authorities to establish agricultural instruction. In the same year the Government placed an annual sum of £5,000 at the disposal of the agricultural department of the Privy Council (afterwards the Board of Agriculture) for the purpose of aiding agricultural and dairy schools. A number of colleges started work between 1890 and 1901, and three of what are now farm institutes opened between 1889 and 1896. With the setting up of the Development Commission in 1909 fresh funds became available for agricultural education, and it was by means of the development fund that the Board of Agriculture was able in 1913 to launch the scheme for farm institutes. As an outcome of the movement for the development of higher agricultural education, 12 agricultural colleges are now in operation, recognized and assisted by the Ministry of Agriculture.

The aim of a college course in agriculture is held to be to train managers, and the plea is made that particular emphasis be laid upon costs and returns and the organization of labor.

Various economies in teaching are suggested, and the use of the college farm is discussed. If such a farm is to be used for teaching management, it is deemed necessary to conduct it on commercial and not on experimental lines.

The farm institute is distinguished from the agricultural college in that it conducts its instruction by means of short courses of 10 or 12 weeks' duration before and after the New Year. From the point of view of the students at an institute, a farm is not deemed necessary except in so far as it provides for experiments and demonstrations to be used by county organizations and county instructors.

Community value of the consolidated rural school, A. W. Hayes (*Tulane Univ. La., Dept. Sociol., Research Bul. 2 (1923), pp. 45, figs. 6*).—In order to determine and properly evaluate some of the important social features which may accompany rural school consolidation, a personal and statistical study was made of these schools in Louisiana, Mississippi, and Alabama. The in-

vestigation was begun during the latter half of the 1920–21 school year under a cooperative arrangement between Tulane University and the educational division of the Gulf division of the American Red Cross. Questionnaires were sent to the principals of consolidated schools. The data derived from 144 replies are tabulated in this bulletin. Of these 58 were from Louisiana schools, 46 from Alabama schools, and 40 from Mississippi schools.

The investigation shows that school consolidation plans must be laid upon sound community organization principles, with due regard to group choice, the cohesiveness of groups, volume and density of population, and volume of wealth. It is held to have been demonstrated that a population of 1,000 to 1,600 persons and above in the open country of the consolidated school district, containing about 40 square miles of land area, is desirable under ordinary conditions of settlement on the land. Such a population group usually gives from 150 to 200 pupils for a grade department and from 50 to 60 for a high school. A corps of from 7 to 10 teachers may profitably be employed with perhaps one or more special teachers.

There seems to be a tendency in planning the consolidated school building to have all of the grade or elementary school activities and the main activities of the high school on the ground floor. The auditorium and some of the high-school work are then located on the second floor. It is believed that buildings and grounds should receive more careful consideration. Careful planning to include community social and recreational features may in a large measure permit of a real saving from duplication of other community plants. It is maintained that consolidated rural schools are rapidly becoming leading forces in the three States under consideration for stimulating community fairs, boys' and girls' clubs, community pageants, picnics, athletic contests, and similar events. In a few counties where good consolidation plans have resulted in almost 100 per cent of rural school consolidation, the districts practically solve the problem of the local unit for community organization plans.

Status and results of boys' and girls' club work, Northern and Western States, 1921, G. E. FARRELL and G. L. WARREN (*U. S. Dept. Agr., Dept. Circ. 255 (1923), pp. II+29, figs. 12*).—This traces the development of boys' and girls' club work in the Northern and Western States through a period of 10 years.

It is pointed out that the movement began in the form of contests. In the early development of the cooperative extension work the term "contest" gave way to that of "project" in many States, and the programs of work undertaken were state-wide in character, rather inflexible, and planned for school boys and girls who worked individually. As development has taken place the importance of such activities as club field days, club tours, judging contests, public team demonstrations, achievement days, and club fairs or exhibits has been increasingly recognized. The "standard club" is believed to be one of the most important mileposts in the development of boys' and girls' club work, and the requirements for volunteer local leadership have become more closely defined. Certain outstanding features of the work in 1921 are pointed out.

Some of the factors in improving the quality of club demonstrations are the expansion of the county extension program to include boys' and girls' club work, the intensive supervision by State club leaders, and the increased assistance rendered by subject matter specialists.

The practical management of small live stock in connection with the teaching of rural science in elementary schools, JOHNSON ([*Gt. Brit.*] *Bd. Ed., Ed. Pamphlets, No. 38 (1922), pp. 26, pl. 1*).—This report was prepared after a series of visits to elementary schools in England where instruction is given in the practical management of poultry, bees, rabbits, pigs, or goats,

either in connection with school gardening or as specialized nature study, and describes the equipment found and the practices that were being followed.

In 35 counties where instruction of this kind was being given 74 schools were known to be keeping poultry, 62 bees, 19 rabbits, 12 pigs, and 3 goats. Forty-two schools were chosen for special inspection. The following suggestions are offered for the consideration of teachers:

Where rural schools are so situated and staffed as to make their introduction possible without encroaching unduly upon the school subjects, teachers should be encouraged to introduce such practical subjects as they are willing and competent to teach. It is more advisable to keep a few well selected animals or breeds, and the children will probably develop greater interest in the work if they are themselves the owners or part owners of the stock. In all cases careful accounts should be kept by the children of all transactions, and the pupils should be expected to keep notes and records.

Government publications of interest to home economics teachers and students (*U. S. Bur. Ed., Home Econ. Circ. 5, rev. (1923), pp. 16*).—Bulletins and other publications, including posters, are listed under the Government agencies publishing them.

MISCELLANEOUS.

Yearbook of the Department of Agriculture, 1922, H. C. WALLACE ET AL. (*U. S. Dept. Agr. Yearbook 1922, pp. V+1137, figs. 271*).—This contains the report of the Secretary of Agriculture; five special articles abstracted elsewhere in this issue; and the usual statistics, noted on page 391.

Annual Reports of the Department of Agriculture, 1922 (*U. S. Dept. Agr. Rpts. 1922, pp. IX+675, fig. 1*).—This contains the reports of the Secretary and heads of bureaus and other administrative officers. The various reports are also issued as separates.

Thirty-fifth Annual Report of Illinois Station, 1922, E. DAVENPORT (*Illinois Sta. Rpt. 1922, pp. 24*).—This contains the organization list, a financial statement for the fiscal year ended June 30, 1922, brief notes as to the principal lines of work, and a list of publications of the year. The experimental work reported and not previously noted is for the most part abstracted elsewhere in this issue.

Report of the New Hampshire Station for 1922, [J. C. KENDALL] (*New Hampshire Sta. Bul. 208 (1923), pp. 31*).—This contains the organization list, a report on the work of the station, and a financial statement for the fiscal year ended June 30, 1922. The experimental work reported is for the most part abstracted elsewhere in this issue.

Forty-first Annual Report of Ohio Station, 1922, C. G. WILLIAMS (*Ohio Sta. Bul. 362 (1922), pp. LXIII, figs. 9*).—This contains the organization list, a financial statement for the fiscal year ended June 30, 1922, and a report of the director summarizing the work and publications of the station during the year. The current experimental work reported is for the most part abstracted elsewhere in this issue.

Monthly Bulletin of the Ohio Experiment Station (*Ohio Sta. Mo. Bul., 8 (1923), No. 3–4, pp. 33–64, figs. 9*).—This number contains four articles abstracted elsewhere in this issue.

Bimonthly Bulletin of the Western Washington Station (*Western Washington Sta. Bimo. Bul., 11 (1923), No. 1, pp. 24, figs. 9*).—In addition to articles abstracted elsewhere in this issue, this number contains brief articles entitled Considerations in Raising Kale, and Production of Mangels and Silage Crops, both by M. E. McCollam; How to Meet the Insect Problems of Garden and Orchard, by A. Frank; Intestinal Roundworms in Poultry, by W. T. Johnson; and Where Do New Varieties of Fruits Come From? by H. D. Locklin.

NOTES.

Arizona University and Station.—R. B. Thompson, associate professor of poultry husbandry and poultry husbandman, resigned August 30 to accept a position with the Oklahoma College. P. H. Ross, assistant director of the extension service at the University of Missouri, has been appointed director of the agricultural extension service, beginning about September 1.

Arkansas University.—A recent issue of *School and Society* states that an agreement has been reached for a complete coordination of the work of the three agricultural schools with the College of Agriculture of the university. Under the plan accepted, each of the schools will carry on, in addition to the work of high school grade, two years of advanced agricultural subjects. This will be deemed equivalent to two years' work in a junior college or the freshman and sophomore years in the College of Agriculture of the university. Advanced standing will be given by the university corresponding to the amount of work completed. The detailed course of study to be offered by the agricultural schools will be determined jointly by the faculties of these schools and the College of Agriculture.

California University and Station.—Edward J. Wickson, professor emeritus of horticulture and widely known as a writer on a broad range of agricultural and horticultural topics, died July 16.

Professor Wickson was born in Rochester, N. Y., August 3, 1848, graduated from Hamilton College in 1869, and received the M. S. degree from the same institution in 1872. He became editor of *Pacific Rural Press* in 1875, and four years later began his long service at the university, serving as lecturer in practical agriculture, associate professor of agriculture, professor of agricultural practices and superintendent of the extension department, and dean of the College of Agriculture and director of the station until 1913, then as professor of horticulture until his retirement in 1915. He organized the first dairy association in California in 1896 and served as secretary of the State Horticultural Society from 1879. He was the author of a long list of publications, including the following treatises: California Fruits and How to Grow Them; California Vegetables in Garden and Field; California Garden Flowers, Trees, and Vines; One Thousand Questions in California Agriculture Answered; and Second Thousand Questions in California Agriculture Answered.

Delaware University and Station.—G. F. Gray has been appointed assistant horticulturist in the station and instructor in horticulture in the university, vice J. H. Clark, resigned. M. A. Willis has been appointed assistant in agronomy vice G. V. C. Houghland, resigned.

Florida University and Station.—E. L. Ayers, entomologist and pathologist in the extension service, was transferred to the station August 1 as agriculturist. The position is a new one, made possible by increased appropriations of the State legislature, and will deal with a number of problems not heretofore handled by the station, take care of part of the station correspondence, particularly that from new settlers, and participate in the planning and supervising of experiments at the three substations.

John G. Kelly has been appointed laboratory assistant of the Tobacco Substation at Quincy. For the first time in the history of the station, the employment of a full-time librarian has been begun, Mrs. Ida Keeling Cresap having been appointed to the position on August 14.

Kansas College and Station.—The 1923 legislature appropriated $6,000 per annum for the ensuing biennium for the support of outlying experimental fields in southeastern Kansas. The first of these fields has been established in Cherokee County, and experimental work on it has been begun. It is expected that about five fields will be located in this portion of the State where soil problems are acute, and that the work of these fields will be devoted chiefly to research in soils, with some important minor work in crops.

The new wing of the agricultural building and the new meats laboratory were occupied September 1. The new wing is 75 ft. wide, 170 ft. long, and 4 stories high, with a 1-story creamery annex 75 by 50 ft. The department of dairy husbandry will occupy the two lower floors of the building, the department of poultry husbandry the third floor, and the department of agricultural economics the top floor.

Appointments have recently been announced of Don C. Warren as associate professor of poultry husbandry, A. D. Weber as instructor in animal husbandry, R. H. Lush as instructor in dairy husbandry, and Earl B. Working as associate professor of the milling industry. R. B. Becker has resigned as instructor in dairy husbandry and W. R. Horlacher as instructor in animal husbandry. George A. Dean, head of the department of entomology, has been appointed entomologist in charge of cereal and forage insect investigations in the Bureau of Entomology, U. S. Department of Agriculture, beginning September 1.

Kentucky University and Station.—S. C. Jones, superintendent of experiment fields, was transferred to the extension division August 1. Recent appointments in the station include J. F. Freeman as superintendent of experiment fields, E. M. Johnson as assistant agronomist, Dr. D. A. Sanders as assistant in the department of veterinary medicine, and R. A. Stevenson, jr., as inspector and Miss Jessie Terry as seed analyst in the department of entomology and botany.

Louisiana Stations.—The contract was let August 3 for the construction of the live stock judging pavilion on the new university site. The pavilion will cost about $58,000, will be of steel frame construction with brick walls, and will have an arena 183 ft. long and 59 ft. 10 in. wide. Seats will be provided to accommodate about 2,000 people. It will occupy a position between the dairy cattle and beef cattle barns.

B. W. Lafene, a recent graduate of the University of Michigan, has been appointed instructor in bacteriology, beginning September 20.

Approximately 1,000 boys and girls attended the annual summer short course held from July 28 to August 4 for club boys and girls of the State.

Michigan College.—C. J. Overmyer, formerly instructor in chemistry, has been granted the degree of Ph. D. for work in organic chemistry by Oxford University. Mr. Overmyer, a graduate of the college in 1918, is said to have been the first Rhodes scholar from a land-grant college, as well as the first American to receive the Ph. D. degree from Oxford in chemistry.

Missouri University and Station.—M. F. Miller, chairman of the department of soils, has been granted leave of absence until February 1, 1924, for the purpose of making investigations of soil management problems in the better agricultural sections of the Middle West. Recent appointments include Donald R. Cowan, Ph. D., as assistant professor of marketing, W. L. Witte as assistant professor of rural sociology, and J. B. Nelson as assistant professor of dairy husbandry.

Nebraska University and Station.—R. W. Dawson, assistant professor of entomology and assistant in entomology in the station, resigned July 1 to take up postgraduate work in the University of Minnesota. Don B. Whelan has been appointed instructor in entomology and assistant in entomology in the

station. Paul A. Downs, Ph. D., has been appointed assistant professor of dairy husbandry and associate in dairying in the station, effective August 1. H. D. Fox has succeeded W. H. Savin, resigned, as instructor in animal husbandry.

International Conference of Phytopathology and Economic Entomology.—This conference was held in the Netherlands June 23–July 2, and is said to have been the first occasion at which phytopathologists and entomologists of all countries have met together for the discussion of matters of common interest. Prof. H. M. Quanjer of Wageningen presided over the conference, with Dr. L. O. Howard, chief of the Bureau of Entomology, U. S. Department of Agriculture, as honorary president. About 26 countries were represented by some 65 members in addition to those in attendance from the Netherlands.

The conference assembled at Wageningen June 23 for a 2-day session, at which addresses of welcome were delivered by Professor Kielstra, rector magnificus of the University of Wageningen, and the Netherlands minister for home affairs and agriculture, and participated in by Jonkheer Van Citters of the new laboratory for potato research of the university. The members then divided into two parties, one visiting work in progress at Groningen and the other several nurseries producing ornamentals and the laboratory of Dr. Van Slogleren at Lisse for the study of bulb diseases. The parties then united for a final session at the laboratory of Professor Westerdijk at Baarn and a reception by the minister for home affairs and agriculture.

Much attention was given by the conference to research, both botanical and entomological, which centers around plant diseases of the virus type, and to the efficiency of controlling the spread of insect pests from one country to another by means of a phytopathological service. Considerable discussion took place as to plant import regulations and quarantines, and a resolution was adopted expressing "full agreement with the essentials of international trade and commerce in living plants and plant products, namely, reasonable freedom from all insect pests and plant diseases of all kinds of materials imported into or exported from any country."

A committee with Professors Quanjer as chairman and Schoevers as secretary to undertake the arranging of another conference was appointed.

Cotton Research in the British Empire.—The Empire Cotton Growing Corporation has made grants of £1,000 to each of five institutions for five years. The funds are to be used for the development of research likely to be of importance in relation to problems connected with cotton growing. At Rothamsted the funds are to be used in increasing the staff and equipment of the soil physics department and for special studies of water relationships in districts where cotton is grown. At the University of Manchester the grant will be used to promote research in mycology and entomology, particularly as to diseases of plants caused by fungus parasites likely to be of importance in cotton growing.

Poultry Research in Great Britain.—Plans have been completed for the development of research in poultry breeding and nutrition at the Cambridge University School of Agriculture and in poultry diseases at the Veterinary Laboratory of the Ministry of Agriculture at New Haw, Weybridge. About $24,000 is to be expended for equipment, of which one quarter will be contributed by the poultry industry through the National Poultry Council. The remainder will be supplied from the Development Fund, together with the entire cost of maintenance until March 31, 1927.

The project also contemplates poultry educational work and commercial experiments at Harper Adams Agricultural College, practical breeding experiments for egg production at some center in the north of England, and

experiments in breeding for table production at a center in the south of England. Details are not yet completed for this phase of the work.

Experiment Stations in Finland.—Agricultural experimentation in Finland is now being reorganized under a law passed this year, putting this work on a permanent basis. Research is now being conducted mainly by eight institutions. Of these the Central Agricultural Experiment Station situated at Dickursby, Anas, about 10 miles from Helsingfors, is operated by the Government. It is organized into departments of plant cultivation, agricultural chemistry and physics, biology of domestic animals, plant bacteriology and diseases, and agricultural entomology. Each department is under the direction of a professor of the University of Helsingfors, and the staff also includes an assistant and a clerk with university training. Besides comparative vegetable tests, plant breeding is carried on, special attention being given to the breeding of oats. Many students of the agricultural department of the university are given training each year.

The Government Bureau for the Examination of Butter and other Edible Fats is located at Hango. Its principal work consists in the examining of butter to be exported from the country, but it also conducts investigations of other food fats. It has a staff of dairy experts and chemists.

The Economic Investigational Bureau of the Agricultural Administration at Helsingfors conducts inquiries based on data procured from several hundred privately owned farms. The chief object is to furnish information in regard to the costs of agricultural production and the profitableness of various sized farms in different parts of the country.

The agro-geological section of the Geological Commission, also at Helsingfors, conducts investigations in regard to soils and prepares agro-geological maps for the different sections. This institution is maintained with State funds.

The Swamp Cultivating Experimental Station of Lettensue is located about 75 miles north of Helsingfors. It is owned by the Suomen Suoviljelysyhdistys (Finland Swamp Reclamation Society), which receives financial aid from the State. The station conducts experiments in the cultivating, ditching, and fertilizing of swamps. Similar stations are located at Ilmajoki, about 270 miles north of Helsingfors, where special attention is given to pasture studies on peat bogs, and at Tohmajarvi, about 417 miles east of Helsingfors.

The Plant Breeding Station of Tammisto at Malm, about 7 miles from Helsingfors, is owned by the Keskusosuusliika Hankkija (Hankkija Cooperative Society). Its work consists in the breeding of the more important plants, and it is under the direction of a trained specialist.

In addition to the foregoing, the cattle breeding societies operating in Finland and receiving State aid conduct, in connection with the keeping of records of purebred stock, investigations in regard to the heredity of domestic animals. Of these societies the most important are the Society for the Breeding of Ayrshires at Helsingfors, the West Finnish Society for the Breeding of Domestic Animals at Karkku (near Tammerfors), and the East Finnish Society for the Breeding of Domestic Animals at Kuopio.

Necrology.—Dr. J. G. Rutherford, member of the Board of Railway Commissioners of Canada and formerly veterinary director-general and live stock commissioner for the Dominion, died at Ottawa July 24 at the age of 65 years. Dr. Rutherford was the representative of Canada at the International Institute of Agriculture at Rome in 1908, president of the American Veterinary Medical Association from 1908 to 1911, chairman of the International Commission on the Control of Bovine Tuberculosis, and chairman of the Canadian Reindeer

Commission. He was also largely instrumental in improving the status of veterinary education in Canada and in the establishment of a pathological division and biological laboratory in the Dominion Department of Agriculture.

Prof. Dr. Lawrence Hiltner, president of the Bavarian State Institution for Plant Culture and Plant Protection, died June 6.

Professor Hiltner had taken an energetic and successful part in work along the lines of soil biology, variety testing, plant protection, climatology, meteorology, and the fertilization of vineyards. The results of his research in these fields were placed at the disposal of the German Agricultural Society and were made available to the general public through lectures and articles. He was generally recognized as a thorough research worker and an expert advisor. Because of his noteworthy service he was, in 1904, made a member of the executive committee of the German Agricultural Society, and in 1910, on the occasion of the twenty-fifth anniversary of the society, he was awarded the large bronze and the large silver Eyth Memorial Medal.

Dr. Frank C. Cook, physiological chemist of the insecticide and fungicide laboratory of the Bureau of Chemistry, U. S. Department of Agriculture, died in Dallas, Tex., June 19, at the age of 46 years. He had been in the employ of the bureau since 1904 and had studied a large number of chemical problems, including meat juices and extracts, the preparation, properties, and action of copper sprays, the effect of cold storage on poultry products, the destruction of fly larvae in manure, etc. He was the author of numerous papers and bulletins on food metabolism, enzyms, insecticides, fungicides, and related subjects.

Word has just been received that Charles Lemarié, chief inspector of the Agricultural Service and associate director of the Economic Service of Indo-China, died January 29 at the age of 56 years. He had been engaged in the promotion of French colonial agriculture since 1896, establishing the Department of Agriculture at Tonkin. He had contributed many articles to the *Bulletin Économique de l'Indochine* and other publications and was a joint author of the *Catalogue des Produits de l'Indochine*.

New Journal.—*Annales de parasitologie humaine et comparée* is being published quarterly under the direction of Prof. E. Brumpt and will consist of original articles, reviews, notes, reports of new genera and species, etc. The initial number contains articles on The True *Strongylus tetracanthus* and Its Pathogenic Rôle, by A. Raillet; The Fatal Theilerosis of the Mediterranean Basin Due to *Theileria mutans*, by E. Brumpt; Contributions to the Study of Diseases and Parasites in Moroccan Cattle, by H. Velu; Note on *Multiceps spalacis*, by C. Joyeux; Treatment of Equine Dourine with Bayer 205, by L. Balozet et al.; Treatment of Trypanosomiasis from *Trypanosoma marocanum* with Bayer 205, by G. Lavier and H. Velu; Treatment of a Case of Babesiosis of the Dromedary by Bayer 205, by L. Herzog and G. Lavier; The Oscillary Parasites of the Intestinal Canal of Man and Animals, by M. Langeron; and The Evolution of the Classification of the Culicidae, by M. Veveu-Lemaire.

EXPERIMENT STATION RECORD.

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The recent announcement of the location by the Forest Service of its two new forest experiment stations at the Massachusetts and Minnesota colleges of agriculture is a development of much interest, whether viewed from the standpoint of forestry research in general or that of the institutions immediately concerned. It extends the cooperative relationships of the Forest Service with these colleges, bringing it into direct contact with them on a matter of mutual concern. It insures the inauguration of experimental work in sections of this country hitherto inadequately provided for, and it makes possible its systematic prosecution under very favorable conditions.

One of the new stations is to be called the Northeastern Forest Experiment Station and will have its headquarters at Amherst, Mass. Under the terms of the cooperative agreement, the Massachusetts Agricultural College will furnish laboratories and offices for the station and space for a small nursery, and will provide facilities for experimental work on the college forest of 700 acres on Mount Toby, some ten miles from the campus. The forest station staff of several specialists will be available to the college for an occasional series of lectures on forestry, and is expected to provide opportunities for more or less research work by students.

The other new station has been christened the Lake States Forest Experiment Station. Its headquarters will be at St. Paul, under a cooperative agreement with the College of Agriculture of the University of Minnesota, which will furnish laboratory and office space. The extensive facilities of the university's forestry substation at Cloquet, with its tract of 2,640 acres and where a considerable amount of silvicultural work has been under way for many years, will also be available, making the opportunities for research unusually attractive. One of the primary objects of this station will be to devise ways and means for making the immense area of cut-over and nonagricultural lands in the Lake States once more productive. It is estimated that the region now contains over 20,000,000 acres of

cut-over land, for the most part nonagricultural in character and not now used for any purpose, although the section as a whole is becoming an importer of timber.

One promising undertaking which it is hoped to accomplish will be the organization of a research council for each of the two regions, with representatives of the forest schools, State forestry departments, agricultural colleges, and forest industries of New England and New York in the one case and the Lake States in the other. The main function of these councils will be to consider the advisability of new projects, the location of field work, and the ascertaining of agencies capable of undertaking projects or cooperating with the stations. In this way it is thought the interests of the entire section can be brought together to formulate a plan of investigation to meet the needs of the region with a minimum of duplication or overextension of activities.

The two new stations will be the first which the Forest Service has located at an agricultural college, but they by no means represent its initial efforts in forestry experimentation. Fully ten years ago cooperation was instituted with the University of Minnesota at the Cloquet Substation already referred to. The real beginning in this field, however, was even earlier, dating from the establishment of the Fort Valley Forest Experiment Station, located near Flagstaff, Ariz., in the Coconino National Forest in the summer of 1908. In the ensuing five years, five additional stations were opened, two of them in California and one each in Washington, Idaho, and Colorado. A small technical staff was built up at each station, a program of investigations having to do with fundamental problems of forest management was laid out, and experiments involving consistent prosecution of work for a term of years were begun. Various causes, however, interrupted the continuity of the work. Financial exigencies following the war led to the closing of the two California stations, and in 1920 all but one of the remaining stations were reduced to a one-man basis. This involved suspending many of the studies under way and curtailing the rest materially.

With the beginning of the fiscal year 1921 the reopening of the Priest River Station in the northern Rockies of Idaho became possible, with funds aggregating about $12,000 per annum. In addition, provision was made for the opening on a similarly modest scale of two stations in the Eastern States, one with headquarters at New Orleans and the other at Asheville, N. C. This trio of stations constitutes, with the two just established, the existing organization and represents some of the main forest regions of the country.

In addition to the work under way at specifically designated stations, a large number of experiments have been conducted less

formally on the various national forests from time to time, and to some extent in cooperation with States on lands controlled by them. Particular mention should also be made of the extensive specialized investigations of the most effective methods of utilizing forest products which have been carried on since 1910 at the Forest Products Laboratory at Madison in cooperation with the University of Wisconsin, and of the grazing studies in progress for several years at the Great Basin Experiment Station in Utah and at numerous points in Arizona and New Mexico.

The forest experiment stations are the result of a realization of the need for scientific information which could be secured only in a systematic manner and by intensive methods of study. In discussing this matter, a recent report of the Forest Service states that "in the development of national forestry such stations are fundamental. Their function is to secure the scientific basis necessary for the growing and production of timber, alike on public and private lands. They can do this in the quickest, most effective, and most authoritative way, for they substitute systematic, well-directed research as a means of solving the problems of forest management in place of slow progress by the method of trial and error. Hardly less will be their value as demonstration areas illustrating successful methods of timber growing."

Prior to the undertaking of investigations, scientific forestry in this country had for its principal foundations the empirical knowledge derived from practical experience, supplemented by such adaptations as could be made of the results of European research. In Europe, to be sure, forest experiment stations are said to have been in existence for over 100 years, and in Germany a distinctive system had been developed since the establishment of the first official station in 1870 at Baden in connection with the Polytechnicum at Carlsruhe. So great, however, are the differences in conditions that it early became apparent, much as had been the case with agricultural research, that the principal contributions to this country which the European stations could make would be as object lessons of the benefits which systematic research may be expected to bring.

The analogy between the needs of forestry and agriculture as regards experimentation has been frequently cited as an argument for the inauguration of a system of forestry stations. A recent publication of this Department points out that "like agriculture, forestry in the United States is a basic industry and must underlie and support all other industries. Both utilize land in the continuous production of necessary materials. Food and clothing are but little more essential to our present-day civilization than the wood which in one form or another enters into practically every human activity. The forest experiment station is as necessary to

forestry as the agricultural station is to agriculture. The relations are identical. Just as the agricultural station, for example, must develop methods for dry land farming, so must the forest experiment station develop methods for timber production in the sandhills. Comparisons could be multiplied indefinitely. Both show the means for producing maximum crops of the desired kinds—on the farm the growth of a single season, in the forest the production of decades or of a century. Both aim at the present production of wealth per unit of effort and per unit of land."

In this connection the fact should not be overlooked that several of the agricultural experiment stations have themselves given considerable attention to certain phases of forestry investigation. In 1903 four of these stations listed forestry among their principal lines of work, and a decade later the number thus reporting had been increased to 13. In 1923, 22 States and Territories reported projects to an aggregate number of 82, these including 16 from Minnesota, 15 from Iowa, 9 from California, 6 from Ohio, 5 from Pennsylvania, 4 each from Michigan and Cornell, 3 each from Idaho and New Hampshire, 2 each from Kansas, North Dakota, Oklahoma, and Vermont, and a single project each from Alaska, Colorado, Louisiana, Maryland, Mississippi, Montana, Porto Rico, South Carolina, and Texas. In view of the restricted resources of the stations and the insistent demand for experimentation over a wide range of strictly agricultural lines, this showing is perhaps as comprehensive as should be expected.

The scope of the stations' work has been usually recognized as confined somewhat closely to such matters as the development and utilization of the farm woodlot, the provision of a supply of fence posts, fuel, and timber of various sorts for use on the farm, comparisons of the durability of various woods, and the testing of species suitable for windbreaks and shade. Thus, Director Thorne of the Ohio Station, in a paper delivered before the Society for the Promotion of Agricultural Science in 1905 on The Relation of the Experiment Station to Forestry, declared that "the experiment station was not established for administrative work and should not be burdened with such work. It therefore has little concern for State forestry, except as such forestry may give opportunity for the study of some of the problems in tree growth which could not otherwise be obtained. With the farm woodlot, however, the experiment station is deeply concerned, and if it fails to take its rightful position of leadership in the encouragement of forest-tree culture on the farm it will miss one of its most important opportunities."

In the early days of the stations, such forestry work as was undertaken was usually carried on by the horticulturist and commonly

consisted of simple tests of indigenous and exotic species suitable for farm purposes. Regional needs played an important part in the program. From the Arizona, California, and New Mexico Stations came reports upon the behavior of various species of Eucalyptus, a genus introduced from Australia in an attempt to secure rapid growing trees of heat and drought resistant qualities. The northern Great Plains States, Wyoming, Nebraska, North and South Dakota, and Iowa, carried on tests with Chinese, Siberian, northern Europe, and native species to discover trees sufficiently hardy to survive the droughts of summer and the intense cold winds of winter. Illinois, Kentucky, Iowa, Kansas, Oklahoma, and Ohio were early concerned with tests of the catalpa and black locust as material for posts and fuel, and experiments upon the treating of fence posts with creosote and other preservative materials were reported by the Ohio, Maryland, Pennsylvania, Missouri, Rhode Island, Iowa, and other stations.

The proper handling of cut-over lands was then, as now, an important problem in Minnesota, Wisconsin, and Michigan. As early as 1896, the Minnesota Station reported upon studies on the rate of growth upon cut-over areas and upon the urgent necessity of keeping out fires. The replanting of the white pine forests has been the chief concern of the New England stations, as evidenced by reports on nursery and planting practices with white pine from Vermont, New Hampshire, Massachusetts, and Connecticut. On the other hand, very little forestry work has been carried on by the Southern States, perhaps because of the relatively abundant supplies of virgin timber. In general only such questions as were of immediate concern to the farmer have been considered, although there has necessarily been work on the problems of reproduction, the growth of seedlings, ecological conditions in forests, tolerance of species for light, and other environmental factors.

Few principles of universal application have been evolved, although in the aggregate considerable useful information has been obtained and disseminated, and some of the projects have yielded results of much more than local significance. In a series of reports published by the Vermont Station upon the general subject of tolerance of New England forestry trees, it has been shown that, although light is a highly important factor in the growth of the seedling and the mature tree, other environmental factors, such as soil moisture and soil fertility, may be of even greater importance. At the same station it was found that the damping-off of young tree seedlings in the nursery may be prevented by the use of formaldehyde or sulphuric acid. The Wyoming Station, early in its history, reported that the death of trees and shrubs in winter was probably due to

desiccation following excessive transpiration in rarefied air and direct insolation, rather than to low temperatures. The South Dakota Station found that the humidity within groves of forest trees was much higher than in outside areas, and the Iowa Station that the distribution of forest trees is influenced by the type of soil. In studying the rate of growth in different species of oak, the Missouri Station showed that marked differences existed in the amount of growth during the first hundred years of their life. The California Station has contributed valuable information on the preparation of volume tables, particularly for California species. The hybridizing experiments with the oak conducted at the Texas Station have indicated the possibility of developing valuable new forms of forest trees.

These instances are cited as typical of some of the results which have been accomplished, for the most part by stations unable to devote more than a minor share of their resources to the work. Today, when the provision of forestry instruction has made available to many institutions the services of one or more men with advanced forestry training, the opportunities for both a greater number and a more fundamental type of studies would seem to be considerably increased. The progress of such instruction likewise enforces the necessity for research which will develop basic principles and the conditions of their application.

A material stimulus should result from the development of the regional forest stations of the Forest Service; and the location of the newest of these stations at agricultural colleges and the announced policy of instituting regional forest councils indicate that the possibilities for active cooperation among the various agencies interested in forestry research will not be neglected. This should do much to conserve resources and concentrate activities at points where efforts will be most effective.

RECENT WORK IN AGRICULTURAL SCIENCE.

AGRICULTURAL CHEMISTRY—AGROTECHNY.

Quantitative agricultural analysis, E. G. Mahin and R. H. Carr (*New York and London: McGraw-Hill Book Co., Inc., 1923, pp. XIII+329, figs. 62*).—This laboratory manual, which is designed for a college course in quantitative chemistry with particular reference to agricultural chemistry, consists of three parts. Part 1 consists of a brief introductory course in general quantitative analysis. In part 2 special instruments required for quantitative measurements are described, with a brief discussion of theoretical principles and directions for making the measurements and applying the results. The chapter headings of this section include density and specific gravity, heat of combustion (calorimetry), index of refraction, optical rotation (polarimetry), and H-ion concentration.

Part 3 deals with the analysis of agricultural materials, including feeds; saponifiable oils, fats, and waxes; dairy products; soils; fertilizers; and insecticides and fungicides. In this section considerable attention has been given to the significance of the results of analyses in connection with agricultural problems.

Pharmaceutical and food analysis, A. Thurston (*New York: D. Van Nostrand Co., 1922, pp. XIII+416, figs. 19*).—This volume consists of introductory chapters on the polariscope, refractometers, specific gravity, and general methods of analysis. These are followed by chapters on definitions, standards, and methods of analysis of oils, fats and waxes, dairy products, flesh foods, eggs and egg substitutes, and volatile oils. Frequent references to the literature are given as footnotes, and each section closes with a bibliography.

Yearbook for agricultural chemistry, edited by F. Mach (*Jahresber. Agr. Chem., 4, ser., 3 (1920), pp. XXXII+584*).—This volume continues the series previously noted (E. S. R., 47, p. 201).

The use of benzidin as a sensitive test for phosphoric acid, F. Feigl (*Ztschr. Analyt. Chem., 61 (1922), No. 12, pp. 454–457*).—To prove that a yellow precipitate with ammonium molybdate is phosphoammonium molybdate and not an analogous salt of arsenic, the author recommends moistening the washed precipitate directly on the filter paper with benzidin hydrochlorid to which a little acetic acid has been added, and then holding the filter over an open bottle of ammonium hydroxid. If phosphorus is present the yellow precipitate turns blue. It is said to be possible by means of this test to detect in 10 cc. of solution 1 part of P_2O_5 in 300,000 of water. In conducting the test the ammonium molybdate solution should be freshly prepared, and a good grade of quantitative filter paper should be employed.

A modified test for sour soils, N. M. Comber (*Jour. Agr. Sci. [England], 12 (1922), No. 4, pp. 370, 371*).—An aqueous solution of potassium salicylate is recommended as a useful substitute for an alcoholic solution of the thiocyanate in testing sourness in soils, a red color developing in a few minutes in the case of sour soils and a yellow or brownish yellow color in others. The salicylate

is generally used in a 5 per cent solution, although quicker results may be obtained with more concentrated solutions.

The mineralization of histological sections by calcination and its interest as a general histochemical method, A. POLICARD (*Compt. Rend. Acad. Sci. [Paris], 176 (1923), No. 15, pp. 1012–1014*).—The technique is described for ashing in an electric furnace histological sections of animal tissue fixed by formalin or alcohol, the object being to free the inorganic constituents from the organic at the place which they occupy in the living tissue.

Histochemical detection of total iron in tissues by the method of incineration, A. POLICARD (*Compt. Rend. Acad. Sci. [Paris], 176 (1923), No. 17, pp. 1187–1189*).—The method described in the paper noted above has been applied to the detection of iron in animal tissues. It is stated that in suitably-ashed samples the presence of iron can be detected under the microscope by the color of the iron oxid. If the amount of iron is relatively small the color is yellow, while if considerable iron is present the color is deep red. The specimen should be examined by reflected light. The test is said to be very sensitive, it being possible to detect 1 part in 50,000 of metallic iron.

Detection of sugars in condensed waters by means of cresol, G. E. STEVENS (*Indus. and Engin. Chem., 15 (1923), No. 4, p. 363*).—The author recommends cresol as a substitute for α-naphthol for detecting sugar in condensed waters. The cresol is used in solution in castile soap in the proportion of 15 cc. of cresol to 6 gm. of soap dissolved in 100 cc. of water. It is stated that the solution can be made up in liter quantities without deterioration.

In practice, the water to be tested is poured into a 6 by $\frac{5}{8}$ in. test tube to the depth of about an inch, and to this are added 5 or 10 drops of the cresol solution. After the contents of the tube have been thoroughly mixed and cooled, concentrated sulphuric acid is added cautiously from a burette (the tube being held in a slanting position) until the acid layer is from $\frac{1}{2}$ to $\frac{3}{4}$ in. deep. On rolling the tube between the hands a reddish black to pink color ring appears if sugar is present, the color varying with the amount of sugar. In very dilute solutions the color does not appear immediately, but on standing a half hour the presence of 1 part of sugar to 1 million parts of water can be detected.

Estimation of sugar in the blood, E. G. B. CALVERT (*Biochem. Jour., 17 (1923), No. 1, pp. 117–129, figs. 3*).—The method described is based upon the methods of Folin and Wu (E. S. R., 42, p. 712) and of Wallis and Gallagher (E. S. R., 44, p. 506). The technique has been simplified by collecting and weighing the blood in a special platinum capsule which is then quickly immersed in water in a test tube. A further modification consists in the use of colored glass standards instead of a special solution. To increase the accuracy of the determination, a curve of correction has been worked out for use when the solutions are of higher or lower sugar concentration than the standard solution.

The determination of ash in Cuban raw sugar, U. S. JAMISON and J. R. WITHROW (*Indus. and Engin. Chem., 15 (1923), No. 4, pp. 386–389; also in La. Planter, 70 (1923), No. 15, pp. 290–292*).—A comparison is reported of the sulphate method of determining ash in raw sugar with various modifications of the direct incineration method. All of the tests were conducted on a Cuban raw cane sugar of 96° polarization, which was ground to a fine powder and mixed thoroughly before sampling.

In the direct incineration method the technique employed consisted in heating the 2 to 5 gm. sample of sugar in a porcelain crucible on an electric hot plate until carbonized, igniting to white ash at a low red heat in the muffle, and continuing the heating for 10-minute periods until constant weights are obtained. This technique is said to do away with the tendency to foam. The

method as thus applied is considered to be much simpler and more rapid than the sulphate method. The only advantage in the latter is the increase in the weight of the ash which makes easier the weighing of small quantities. The value of the sulphated ash, even with the customary 10 per cent correction, was about 34 per cent higher than the values obtained by direct incineration.

The relative merits of the various modifications of the direct incineration method are summarized as follows: "The benzoic acid modification is rapid, but gives a fluffy ash, easily lost. The vaseline oil modification is a good preventive of the foam-over trouble; ammonium carbonate causes loss by spattering; ignition with sand reduces foaming, but prolongs the carbon combustion and gives low results; zinc oxid prevents foaming and evidently retains volatile ash constituents, giving results between the direct incineration and the sulphate methods; and lixiviation methods show no advantage over ordinary direct incineration."

It is thought that the technique of the gravimetric method can be improved with regard to speed by treating the weighed sample of sugar directly with a 2:1 sulphuric acid solution, heating on a hot plate until completely carbonated, and then ashing. After the ash has cooled a few drops more of the acid are added and the heating is continued for 15 minutes.

Porcelain crucibles were found to give as accurate results as platinum in both the sulphate and direct incineration methods.

An improved method for the determination of α-, β-, and γ-cellulose, M. W. Bray and T. M. Andrews (*Indus. and Engin. Chem., 15 (1923), No. 4, pp. 377, 378*).—The method described is a volumetric one depending upon the separation of the alkali-soluble and alkali-insoluble celluloses, the oxidation of each with potassium dichromate in sulphuric acid solution, and the titration of excess dicromate with ferrous ammonium sulphate solution. The potassium dichromate solution is first standardized against cellulose obtained by the chlorination method of Cross and Bevan from sulphite pulp. The general scheme for the separation and determination of the celluloses is as follows:

One gm. of the dried sample is weighed in a 250-cc. beaker, triturated with 25 cc. of 17.5 per cent NaOH solution until the mass is homogeneous, and allowed to stand for 30 minutes. The contents are then filtered with suction through an alundum or Gooch crucible, and the precipitate is washed with 50 cc. of 4 per cent sodium hydroxid solution, and then with about 300 cc. of distilled water in small quantities. The precipitate, which consists of the alkali-insoluble or α-cellulose, is removed from the crucible to a 250-cc. beaker, dissolved in approximately 30 cc. of 72 per cent sulphuric acid, transferred to a 100-cc. graduated flask by washing with successive portions of the acid, and filtered to the mark. A 10-cc. aliquot is pipetted into a 250-cc. pyrex beaker, and to it are added 10 cc. of standard dichromate solution and approximately 60 cc. of 72 per cent sulphuric acid. The mixture is boiled gently for 5 minutes, cooled on ice, and the excess dichromate titrated with ferrous ammonium sulphate solution.

The filtrate from the original digestion with sodium hydroxid is diluted to 400 cc. and divided into two equal portions. An aliquot of one of these is oxidized with potassium dichromate as above, and from the titration the sum of the β-and γ-celluloses is obtained. From the other portion of the alkaline filtrate the β-cellulose is precipitated by rendering the solution acid and diluting to 250 cc. After the precipitate has settled, a 25-cc. portion of the supernatant liquid is pipetted off and used for a similar oxidation with potassium dichromate to determine the percentage of γ-cellulose. The percentatge of β-cellulose is obtained by difference.

Some new reactions for the detection of sterols, G. S. WHITBY (*Biochem. Jour., 17 (1923), No. 1, pp. 5–12*).—Three new color reactions for sterols and one for sterolin are described and discussed.

Reaction A, which is an elaboration of the Salkowski test but is said to be ten times as sensitive, consists in adding to 2 cc. of a chloroform solution of the sterol (containing preferably from 1 to 2 mg. of the sterol) 2 cc. of a mixture of 50 parts of concentrated sulphuric acid and 1 part of formalin. On shaking the contents of the tube the chloroform layer, which separates on top, has a cherry red color and the lower sulphuric acid layer a brownish red color with intense green fluorescence. If the upper layer is poured into a dry test tube and treated with 2 or 3 drops of acetic anhydrid, the color changes to a bright blue, passing later into a green color. This test is said to give identical results with cholesterol and phytosterol.

Reaction B consists in adding to 2 cc. of a solution in glacial acetic acid of from 0.2 to 0.5 mg. of sterol, 24 drops of a mixture of 50 parts of concentrated sulphuric acid and 1 part of formalin. This forms a rose-colored fluorescent solution, the limits of sensitivity being 1 in 200,000. This test is said to be more sensitive than any other color reaction for sterols.

Reaction C, which is said to be of value chiefly for cholesterol, consists in adding a few milligrams of the sterol to 1 drop of acetic anhydrid on a piece of porcelain and heating gently until it has melted and the excess anhydrid has been driven off. On cooling the melt and moistening it with concentrated nitric acid, a blue or blue-green color develops.

Note on the sulphuric acid test for liver oils, A. HARDEN and R. ROBISON (*Biochem. Jour., 17 (1923), No. 1, pp. 115, 116*).—In this brief note of comment on the sulphuric acid color test for liver oils described by Drummond and Watson (E. S. R., 48, p. 758), attention is called to the observation that the purple color given by liver oils can be simulated by adding a drop of concentrated sulphuric acid to a light petroleum solution containing both cholesterol and furfuraldehyde, and that the addition of furfuraldehyde to fats such as butter, which of themselves give only a faint color test, causes the production of a deep purple color on the addition of the sulphuric acid. The reaction is recommended as a delicate test for cholesterol. Using 5 cc. of light petroleum containing an excess of furfuraldehyde, a faint purple color is said to be produced slowly by as small an amount as 0.1 mg. of cholesterol, while with 0.5 mg. the color is immediate and pronounced.

The analytical detection of rancidity, R. H. KERR and D. G. SORBER (*Indus. and Engin. Chem., 15 (1923), No. 4, pp. 383–385*).—This is a general discussion of the characteristics and causes of rancidity in fats, and of the various tests which have been recommended for its detection. In the authors' opinion the most valuable and generally applicable test is the Kreis test, which has been discussed in a previous paper (E. S. R., 39, p. 313). The principal value of this test in inspection work is thought to be in distinguishing fats which have a disagreeable odor and flavor due to other causes than rancidity.

Determination of the cresol content of cresol soap solutions, L. FRANK (*Chem. Ztg., 46 (1922), No. 52, p. 390, fig. 1*).—A rapid method of determining the cresol content of cresol soaps is described as follows:

In a 250- or 300-cc. separatory funnel are placed 1 gm. of finely crystallized sodium chlorid, about 10 gm. of the cresol soap solution previously weighed in a 50-cc. glass beaker, and 60 cc. of ether, the latter being used to wash out the cresol from the beaker. The contents of the funnel are shaken vigorously, after which 30 cc. of water is added and the funnel rotated a few times, but not shaken actively. After an hour the ether solution is separated from the water,

washed with three successive portions of 10 cc. of water, and filtered through a paper filter containing 5 gm. of calcined sodium sulphate. The filtrate is received in a 300-cc. Erlenmeyer flask, into the bottom of which has been fused a 100-cc. graduated tube, and provided with a round glass disk slightly larger than the opening into the graduated tube. The ether is distilled off on the water bath and the volume of cresol read from its height in the graduated tube.

Evaporation of fruits, J. S. CALDWELL (*U. S. Dept. Agr. Bul. 1141 (1923), pp. 64, figs. 18*).—This is a revision of Farmers' Bulletin 903 (E. S. R., 38, p. 316), with new sections dealing with the construction of the driers, the arrangement of the equipment, the practical details of handling the various fruits, and the choice of fruits to be used for evaporating purposes.

Application of the principles of jelly making to Hawaiian fruits, J. C. RIPPERTON (*Hawaii Sta. Bul. 47 (1923), pp. II+24, pl. 1*).—This is a study of the jellying properties of Hawaiian guava for the purpose of establishing certain general principles which can be applied to any fruit juice containing the necessary amount of natural pectin and acid for jelly making.

The pectin content of the fruit juice was estimated by measuring the volume in cubic centimeters of the undried alcohol precipitate obtained by adding 10 cc. of the juice to 20 cc. of 95 per cent ethyl alcohol. The liquid was filtered through bolting cloth and the precipitate freed from alcohol by rolling back and forth on the cloth. The partially dry mass was then introduced into a measuring cylinder, a glass plunger placed on top, and the volume or "pectin number" read in cubic centimeters. A table of the maximum ratio of sugar to guava juices was worked out for a series of pectin numbers. Chemical analyses of juices and jellies were made according to the methods of the Association of Official Agricultural Chemists.

Studies were made of the juices from guavas collected from three guava producing areas representing widely differing conditions of climate, altitude, and season. Results showed that location had a marked effect on acidity. The proportion of acidity in juices of guavas from the windward side was less than 1 per cent, whereas those from the leeward side averaged 1.5 per cent. The pectin content was highest in fruits from the windward side and lowest in that from the mountain slopes, but in all cases was sufficiently high for jelly making. Seasonal variations were not outstanding, nor did different varieties of guava and different lots of the same variety show any marked variations. Tests made on guavas picked at different stages of maturity showed that while the quantity of juice increased with increasing maturity, the pectin quantity and acidity decreased. The total pectin extracted from the guava was increased by increasing the amount of water in which the fruit was cooked. It was possible to use as much water as fruit by weight without affecting the jellying property of the juice.

Guava juice resembles other fruit juices of high jellying power in that sugar, pectin, and acid can be varied within rather wide limits in jelly making. The maximum ratio for the common guava is 1.75 parts of sugar to 1 of juice providing the acidity is 1 per cent or more. A guava juice having a "pectin number" of 6.75, which is a medium juice, requires an acidity of at least 1.4 per cent (as H_2SO_4) for the highest sugar ratio. The optimum acidity in guava jelly is between 0.6 and 0.75 per cent of the jelly. The optimum pectin content is between 0.48 per cent and 0.7 of the jelly.

Other Hawaiian fruits which lend themselves to jelly making are the Isabella grape, roselle, and poha. Examination of the pectin found in the juices of these four fruits showed that the consistency of a jelly is determined to a

large extent by the physical properties of its pectin. The gelatinous short-fibered pectin found in the grape and roselle produced a weak, tender jelly, while a stronger textured jelly resulted from the guava and poha in which the pectin is dense and long fibered.

Fruit beverage investigations, W. V. Cruess and J. H. Irish (*California Sta. Bul. 359 (1923), pp. 525–568, figs. 15*).—This publication consists of the complete report of the fruit beverage investigations which have been conducted at the station for several years and have been noted from time to time in progress reports (E. S. R., 48, p. 507).

Following a brief introductory section on the extent of the beverage industry and the types of unfermented bottled beverages, the subject matter is presented under the following heads: Preparation of sirups for bottling, preservation of fruit sirups, uses for fruit sirups, use of fruit sirups in carbonated beverages, semicommercial production and sale, and cost of production of fruit sirups and carbonated beverages.

A useful feature of the bulletin is a graphic outline of the process of preparing carbonated beverages from berries and cherries, red grapes, citrus fruits, pomegranates, apples, and white grapes.

Spoilage in canned vegetables, W. G. Sackett (*Colorado Sta. Rpt. 1922, p. 12*).—It is noted briefly that *Bacillus botulinus*, type A, has been isolated from the corn in question in a case of botulism. Much of the spoilage in corn canned by the cold pack method is thought to be due to another spore-forming anaerobe, *B. aerofetidus*.

Virgin wool and shoddy, L. A. Hausman (*Sci. Amer., 127 (1922), No. 6, pp. 410, 411, figs. 10; also in Natl. Wool Grower, 13 (1923), No. 1, pp. 20–22, figs. 5*).—A description is given, with accompanying microphotographs, of methods of differentiating microscopically between virgin wool and shoddy. One of the surest criteria for the presence of shoddy is said to be the appearance under the microscope of fibers of different color in a yarn which microscopically appears to be of one color. This is generally an indication that the fibers of which the yarn is composed have been obtained from many different sources. Shoddy fibers under the microscope show broken or frayed ends, and may be swollen or distorted in shape and lacking in cuticle scales.

"No one of the typical shoddy characteristics alone (except perhaps the presence of multicolored fibers) is sufficient to determine whether shoddy is present. In most shoddies several of the microscopic characters will occur together, and the determination will be thus made more certain."

METEOROLOGY.

The evolution of climate, C. E. P. Brooks (*London: Benn Bros., Ltd., 1922, pp. 173*).—This book records "an attempt to reconstruct in some detail the sequence of climatic changes through which the world passed during that important stage of its geological history which is variously known as the Ice Age or Glacial Period, the Pleistocene, the Quaternary, or the Human Period." The various theories advanced to explain the climatic changes are briefly outlined. The author adopts as the basis for his discussion the geographical theory that "the Ice Age was brought about by elevation in high latitudes and by changes in the land and sea distribution."

Climatological data for the United States by sections (*U. S. Dept. Agr., Weather Bur. Climat. Data, 9 (1922), No. 13, pp. [236], pls. 18, figs. 14*).—This number summarizes the climatological data for each month of 1922 and for the year as a whole for each State.

Climatological data for the United States by sections (*U. S. Dept. Agr., Weather Bur. Climat. Data, 10 (1923), Nos. 1, pp. [195], pls. 4, fig. 1; 2, pp. [196], pls. 4, fig. 1*).—These numbers contain brief summaries and detailed tabular statements of climatological data for each State for January and February, 1923.

[Weather reports for Alaska, 1921] (*Alaska Stas. Rpt. 1921, pp. 7, 16, 23, 24, 33, 34, 44, 45, 49–58*).—Tabular summaries of observations on temperature, precipitation, and cloudiness at 39 Weather Bureau stations in Alaska are given, and weather conditions in relation to crop production and other kinds of farm work at the Sitka, Matanuska, Fairbanks, Rampart, and Kodiak Stations are briefly discussed.

Meteorological observations, 1921, P. Nelson (*Guam Sta. Rpt. 1921, pp. 41–43*).—Observations on pressure, temperature, rainfall, and velocity and direction of the wind are summarized for the year ended June 30, 1921. The weather conditions during the year may be considered normal except for a rather large number of days of small rainfall from January to June, covering the so-called "dry" season. The total rainfall during this period, however, was too small to be of any value for planting operations. The mean daily temperature of the year was 81.88° F.; the highest temperature, 93° April 29; the lowest, 71° December 1. The total precipitation was 111.41 in., the number of rainy days being 273. A table comparing the monthly rainfall during the four years, 1917–18 to 1920–21, shows that the rainfall for 1920–21 was the highest during the 4-year period.

Meteorology report for 1921, F. E. Hepner (*Wyoming Sta. Rpt. 1922, pp. 167–170*).—Observations at the University of Wyoming, Laramie, on pressure, temperature, precipitation, wind, and cloudiness are summarized.

The year was the warmest ever recorded at this place, the mean temperature being 44° F., or 3.3° above the normal. The highest temperature recorded was 86°, June 29, the lowest, —15°, February 7. The last killing frost in the spring occurred May 19 and the first in autumn September 17, although light frosts were recorded June 20 and in the early part of September. The precipitation was 12.43 in., nearly 2 in. above the normal. Nearly all of the excess rainfall occurred during April, June, and July, with the result that the growing season was better supplied with moisture than usual. September and October were abnormally dry and thus permitted grass to cure well on the winter ranges. There were 220 clear days and 56 per cent of the possible sunshine.

Sulphur, calcium, magnesium, and potassium content and reaction of rainfall at different points in Tennessee, W. H. MacIntire and J. B. Young (*Soil Sci., 15 (1923), No. 3, pp. 205–227, fig. 1*).—This article is based upon analyses made quarterly of rain water collected at ten different points in Tennessee. The results show that "the 8-year average of annual soluble-sulphate sulphur precipitations at the university farm was 51.5 lbs. per acre. The 7-year average in the heart of the city was 94.5 lbs. The 2-year average 7 miles from Knoxville was 18.6 lbs. Three-year averages at seven other points were as follows: Copperhill 232.4 lbs., near Copperhill 72.2, McGhee 24.2, Loudon 19.3, Crossville 12.7, Columbia 26.2, and Jackson 59.2 lbs."

Of over 300 samples tested only two showed slight acidity; the rest were alkaline.

Considerable amounts of calcium and magnesium were found in 13 samples examined for these constituents. A rather uniform potash content was found.

A list of nine references to literature on the subject is given.

Analysis of the air of Sao Paulo, B. de Mattos Filho (*A analyse do ar em São Paulo. Sao Paulo: Sec. Agr. Com. e Obras Pub. Estado São Paulo, Serv.*

Pub., 1922, pp. 105, figs. 48).—Tables and diagrams are given which show rainfall, humidity, cloudiness, direction of the wind, and total and normal ozone and reducing gases of the air for each day of 1920 at São Paulo and of 1921 at the Observatorio dé Campos do Jordão.

SOILS—FERTILIZERS.

[Soil studies at the Guam Station], J. Guerrero (*Guam Sta. Rpt. 1921, pp. 22, 23*).—Analyses of a new unproductive soil taken from grasslands and of an old productive soil are briefly reported, indicating that the former is slightly acid. Pot studies to determine the influence of lime applied in varying amounts to both soils showed that the plants on the soil receiving lime at the rate of 16 tons per acre, especially those in new soil, made very poor growth. In second and third tests, however, the plants in the new soil receiving lime at this rate made slightly better growth and gave larger yields than did those in the old soil receiving the same treatment.

Soil acidity and nitrogen fixation [studies at the Kansas Station] (*Kansas Sta. Bien. Rpt. 1921–22, pp. 15, 16*).—Studies of the correlation existing between the absolute reaction of the soil solution and the presence of Azotobacter, using 418 samples of soil, are said to have shown that pure cultures of Azotobacter will not grow in a medium with a higher acidity than pH 5.9–6, and that no nitrogen fixation takes place in a medium with a higher H-ion concentration than pH 6. No appreciable quantities of acid and basic metabolic by-products were formed by the growth of pure cultures of Azotobacter in laboratory media.

[Fertilizer and soil fertility studies at the Mississippi Station], J. F. O'Kelly (*Mississippi Sta. Rpt. 1922, pp. 12, 13*).—Recent tests are briefly summarized.

Soil investigations [at the Oklahoma Station] (*Oklahoma Sta. Rpt. 1922, pp. 10, 11*).—General data on soil fertility studies at the station, with special reference to the requirements of oats and alfalfa, are briefly summarized. A comparison of oats grown in rotation with continuous culture is said to have shown that it is not advisable to grow oats continuously on the same soil. In cultural methods experiments with kafir, the results showed that shallow cultivation is better than deep cultivation. Shallow cultivation five times during the season and shallow cultivation after rains gave the best returns. Both liming and manuring have been found to be exceedingly important in increasing the activity of beneficial soil organisms at the station.

Soil colloids, P. Ehrenberg (*Die Bodenkolloide. Dresden and Leipzig: Theodor Steinkopff, 1922, 3. ed., rev. and enl., pp. VIII+717, figs. 12*).—This is the third revised and enlarged edition of this book (E. S. R., 44, p. 210), to which have been added facts and principles regarding soil colloids established since the issuance of the second edition.

The chemical characterization of clay and kaolin, E. Blanck and W. Geilmann (*Jour. Landw., 70 (1922), No. 4, pp. 253–257*).—In a contribution from the University of Göttingen partial analyses of 10 samples of kaolin and 19 samples of clay are briefly reported, indicating that the titanium contents of the kaolin samples were generally relatively low and those of the clay samples relatively high. The average titanium oxid content of the kaolin was 0.284 and of the clay 0.885 per cent. While these results are not considered sufficient evidence upon which to base broad general conclusions, the tentative conclusion is drawn that the titanium content may have an important bearing upon the characterization and differentiation of these materials.

A new method for the determination of average diameter of a soil particle, P. E. LANDER (*Punjab Dept. Agr. Rpt., 1921, pt. 2, pp. 39, 40, 51*).—A description is given of this method, together with a brief mathematical analysis, resulting in a formula for permeability of a particular soil to air and water. The tabular data of results of tests of the method indicate that variation in the pore space does not affect the average diameter of the particle. The diameter as calculated from mechanical analyses was found to agree closely with the results obtained by the present method. A slight difference up to 3 or 4 per cent in the percentage of clay in two soils did not materially change the value for the average diameter if calculated from mechanical analyses, while by the method described considerable variation in the value is indicated, and the accuracy of this method is said to lie in this fact. Permeability to air and water and pore space are apparently the important factors in this method.

Classification of organic soils or muck, J. O. VEATCH (*Michigan Sta. Quart. Bul., 5 (1923), No. 4, pp. 196, 197*).—A tabular scheme, indicating the principles upon which the classification of muck soils is made by the station, is presented and discussed.

Soil survey of Houston County, Ala., R. T. A. BURKE and A. T. SWEET (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1920, pp. III+315–344, fig. 1, map 1*).—This survey, made in cooperation with the Alabama Department of Agriculture and Industries, deals with the soils of an area of 370,560 acres lying within the Coastal Plain region in southeastern Alabama. The topography ranges from flat to rolling, and the surface has a general slope to the southeast. Practically all parts of the county are said to be well drained, with the exception of some of the flatter areas in the southern part. The soils are prevailingly sandy in the surface layer, and practially all the well-drained upland soils are said to be either neutral or slightly acid in reaction. Including swamp, 20 soil types of 10 series are mapped, of which the Norfolk and Ruston sandy loams cover 34.1 and 18.2 per cent of the area, respectively.

Soil survey of the Shasta Valley area, Calif., E. B. WATSON ET AL. (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1919, pp. IV+99–152, pls. 4, fig. 1, map 1*).—This survey, made in cooperation with the California Experiment Station, deals with the soils of an area of 327,680 acres, lying in Siskiyou County in northern California. It lies between the large Sacramento Valley and the main agricultural valleys in western Oregon and is a broad structural valley with its longest dimension north and south, bordered on the west by a ridge extending north from the Trinity Mountains and on the east by mountains constituting a part of the Cascade Range. The climate is semiarid. The soils are of residual, glacial, old alluvial, and recent alluvial origin. Including rough broken and stony land, scabland, tailings, and muck and peat, 32 soil types of 16 series are mapped, of which rough broken and stony land and scabland cover 34.8 and 16.5 per cent of the area, respectively. The Lassen clay loam is the most extensive classified type, covering 7.4 per cent of the area. Alkali is found in relatively small amounts, but owing to its concentration at the surface and in spots it is said to be a factor to be reckoned with.

Soil survey of Boone County, Iowa, A. M. O'NEAL and A. M. DEYOE (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1920, pp. III+135–166, fig. 1, map 1*).—This survey, made in cooperation with the Iowa Experiment Station, deals with the soils of an area of 364,160 acres, lying within the Great Plains region west of the geographic center of Iowa. The topography of the greater part ranges from level to gently rolling, and the only areas of strong relief occur along the Des Moines River and some of the larger creeks. It is stated that in many parts of the area the stream channels are poorly defined and that

drainage is inadequate. The soils of the county are derived mainly from glacial drift material and are grouped as upland residual, terrace first bottoms, and organic soils. Including peat and muck, 16 soil types of 9 series are mapped, of which the Carrington, Clarion, and Webster loams and the Webster silty clay loam cover 40.4, 20.1, 16.3, and 11.1 per cent of the area, respectively.

Soil survey of Leavenworth County, Kans., E. H. SMIES and G. Y. BLAIR (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1919, pp. IV+207–271, fig. 1, map 1*).—This survey, made in cooperation with the Kansas Experiment Station, deals with the soils of an area of 294,400 acres in northeastern Kansas. The topography varies from undulating to rolling. It is stated that practically every farm is reached by the intricate drainage system. The soils of the area are of residual, glacial, loessial, and alluvial origin. Including riverwash, 34 soil types of 16 series are mapped, of which Summit silt loam and Shelby loam cover 21.1 and 17.8 per cent of the area, respectively.

Soil survey of Choctaw County, Miss., A. C. ANDERSON ET AL. (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1920, pp. III+249–286, fig. 1, map 1*).—This survey, made in cooperation with the Mississippi Geological Survey, deals with the soils of an area of 264,960 acres, lying within the Coastal Plain region and northeast of the geographical center of Mississippi. The topography consists of rolling uplands and flat stream bottoms. All of the uplands are said to be well or excessively drained, and most of the slopes need terracing to prevent washing. The soils are of old sedimentary, loessial, old alluvial, and recent alluvial origin. Sixteen soil types of 9 series are mapped, of which the Ruston very fine sandy loam and the Pheba, Collins, and Susquehanna silt loams cover 18.7, 18.6, 17.7, and 16.9 per cent of the area, respectively.

Soil survey of Madison County, Nebr., F. A. HAYES ET AL. (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1920, pp. III+201–248, fig. 1, map 1*).—This survey, made in cooperation with the University of Nebraska, deals with the soils of an area of 368,640 acres, lying within the loess region of the Great Plains province in northeastern Nebraska. The general topography ranges from rolling to sharply rolling, except on the broad flat terraces and flood plains bordering the rivers and larger creeks. The rivers, creeks, and intermittent drainage ways are said to afford ample drainage for most of the county. All parts of the eroded loess plain are reached by drainage except the flat areas of Marshall silt loam. The soils of the area are of glacial, loessial, and alluvial origin. Twenty-three soil types of 12 series are mapped, of which the Marshall silt loam covers 43.7 per cent of the area.

Soil survey of Red River County, Tex., W. T. CARTER, JR., ET AL. (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1919, pp. IV+153–206, fig. 1, map 1*).—This survey, made in cooperation with the Texas Experiment Station, deals with the soils of an area of 664,960 acres, lying within the Coastal Plain region in northeastern Texas. It consists of a broad, gently rolling to undulating ridge extending east and west through the central part bordered by belts of flat upland country and these by river bottoms along the northern and southern boundaries. It is stated that numerous small intermittent streams reach into the central part of the county and give fairly good surface drainage except in the occasional flats. The northern and southern parts of the county are said to have inadequate drainage. The soils are of residual and alluvial origin. Including riverwash and chalk, 38 soil types of 24 series are mapped, of which the Susquehanna very fine sandy loam covers 26.9 per cent of the area and is the most extensive individual type.

Soil survey, P. H. CARPENTER and H. R. COOPER (*Indian Tea Assoc., Sci. Dept. Quart. Jour., 1922, No. 3, pp. 75–98, pl. 1*).—The results of a survey of the newer alluvial soils which make up the lower lying tea lands of the Dooars

district in India are presented, including both mechanical and chemical analyses.

Some notes on the "dry-bog" soils of the foothill districts of Tulare County, Calif., G. Surr and R. Vaile (*Calif. Dept. Agr. Mo. Bul., 10 (1921), No. 1, pp. 41–46, figs. 2*).—In a brief contribution from the University of California the fundamental nature of so-called dry-bog soils is considered, and a progress report of field trials with irrigation and tillage methods is presented. It is believed that the shrinkage and resulting cracks and dry bog structure of certain adobe soils are mainly due to the presence of large amounts of plastic or colloidal clay-like material, with a corresponding lack of quartz and of other coarse resistant minerals.

The outstanding features of a series of moisture determinations were the extreme difficulty in getting irrigation water to penetrate deeper than 3 ft. in these soils, and the fact that the maximum penetration of water is reached in 48 hours. The explanation of this is that as soon as the soil is wet the lack of coarse filler permits the swelling shut of the interstices, thus effectively preventing further penetration of water. The work so far carried on with these soils is said to indicate that it is highly desirable to permit the soil to crack somewhat after irrigation before any harrowing or cultivation is attempted.

The soils of Blakeney Point: A study of soil reaction and succession in relation to the plant covering, E. J. Salisbury (*Ann. Bot. [London], 36 (1922), No. 143, pp. 391–431, pl. 1, figs. 5*).—The results of an examination of a large number of samples of soil from phases of very diverse age from Blakeney Point are summarized and discussed, with particular reference to the manner in which they affect vegetation.

It is shown that the dune systems as they grow older exhibit a diminution of carbonates and an increase in organic matter content. These changes are accompanied by a change from an appreciably alkaline condition exhibited by the embryo dunes to a marked acidity in the oldest phases. The accompanying succession in the vegetation is correlated with these edaphic changes.

The H-ion concentration is shown to vary not only with the degree of leaching and organic matter content, but also according to the source of origin of the organic material and the phase of its decomposition. The relation between the organic matter content and the water content of dune soils is shown to be a close one. The so-called shingle banks were found to show a similar sequence, alike in respect to reaction, organic matter content, water content, and stability. The salt marsh phases showed indications of increasing organic matter content, but here the important edaphic factor appeared to be the duration and frequency of tidal inundation.

The nature of soil acidity, H. M. Nagant (*Sci. Agr., 3 (1923), No. 7, pp. 258–261*).—This is a brief summary of findings from different sources on the nature of soil acidity.

Stratification and H-ion concentration of the soil in relation to leaching and plant succession with special reference to woodlands, E. J. Salisbury (*Jour. Ecology, 9 (1922), No. 2, pp. 220–240, figs. 10*).—The results of a number of studies are summarized which showed that natural woodlands exhibit a soil stratification in which a definite gradient can be recognized that is reflected in the macro- and microorganic population. Owing to leaching, the surface soil is most deficient in bases, which increase in amount with increasing depth. On the other hand, the content of organic matter decreases rapidly with increasing depth. This is associated with a gradient of H-ion concentration attaining its maximum at the surface. Exceptions were found on highly basic soils where the manurial action of dead foliage resulted in a higher base

content for the surface soil than for that immediately below. A fairly close relation was established between organic matter content and real acidity, and so-called buffer action is shown to be greatest in the layer of maximum organic matter content.

The view is advanced that woodlands in general, and probably all types of undisturbed plant communities in England, tend to become progressively more acid with consequent changes in the character of the vegetation. High forest has been found to be most favorable to this succession, while the system of so-called standards-with-coppice with short rotation period tends toward its retardation. Woodlands occupying valley slopes tend to exhibit less marked leaching of the surface soil the lower the position on the slope, and the chief differences between upland and lowland woods are considered to be related to this factor. A depression of vegetation zones related to soil factors is said to be a natural outcome of this process.

On the catalytic action of soils, S. Osugi (*Ber. Ōhara Inst. Landw. Forsch., 2 (1922), No. 2, pp. 197–218*).—Experiments on soil catalysis are described, and the results are discussed. Soil was found to decompose hydrogen peroxid to varying degrees. Coagulation and peptization of soil particles resulted in a change in the magnitude of soil catalysis. Usually, peptization increased and coagulation decreased it. Silicates and aluminum oxid had no action on hydrogen peroxid. This is taken to indicate that these soil constituents may not be the cause of soil catalysis.

Humus and ferric and manganese compounds in both sol and gel forms showed very marked catalytic powers. It is thought that these substances may be the main constituents causing the distinct activity of soil on hydrogen peroxid, although no quantitative relation was established between such activity and the content of these constituents. The manganese compounds were the most active and the humus the least. Peptization and coagulation of these substances caused almost the same change in catalytic powers as was experienced with soil, with a few exceptions.

The sulphates and chlorids of manganese and iron in concentrations of from 0.0063 to 0.025 per cent were not able to decompose hydrogen peroxid. It is thought that alkaline and acid reactions in soils may cause soil catalysis. The effect of bacteria on soil catalysis seemed to be small, while that of enzymic substances seemed to be considerable.

Storage of water in soil and its utilization by spring wheat, O. R. Mathews and E. C. Chilcott (*U. S. Dept. Agr. Bul. 1139 (1923), pp. 28, fig. 1*).—This bulletin presents a summary of data made to determine the actual depth to which the wheat crop has utilized the moisture content and fertility of soil in a series of seasons, on a wide range of soils, and under radically different cultivation methods. With knowledge of the field carrying capacity and the minimum point of exhaustion of each soil unit, the soil moisture data are utilized to classify into five groups the extent to which each foot section of soil has functioned each year in the production of spring wheat by three distinct cultural methods at 17 field stations on the Great Plains.

The data indicate that on land producing a crop each year differences in cultural methods are not sufficient to cause major differences in the depth to which water is stored and from which it is recovered. Alternate fallowing and cropping results, on the average, in the utilization of a somewhat greater volume of soil.

It is stated that the depth to which available water is stored may be limited by the shallowness of the soil, but when not limited by soil character the surface 6 ft. of soil may function in the growth of spring wheat. It was

found that except on soils of limited storage capacity the depth to which water is stored in the Great Plains is more often determined by the quantity and character of the precipation than by the storage capacity of the soil.

Available water, when present in the soil, is removed with about the same degree of frequency from each of the first 4 ft. The aggregate quantity of water contributed by each foot section becomes progressively less with increasing distance from the surface. The fifth and sixth foot sections hold still less available water, and the full use of their limited capacity is not frequent. It is concluded that they contribute very little to the total quantity of water used by the crop, but that under certain conditions this contribution may be important.

In about 90 per cent of the years covered by these investigations the soil within the zone of normal root development was dry at harvest time.

It is concluded that the utilization of a large soil mass is not essential to a high yield. The yields depend more upon the maintenance of a constant supply of available moisture at a depth at which it can be easily obtained than upon the mass of soil involved.

Soil improvement for quality of products, M. M. McCool (*Michigan Sta. Quart. Bul., 5 (1923), No. 4, pp. 160, 161*).—The results of investigations of some soil conditions that influence the quality of wheat and rye crops are briefly reported, indicating that the quality of crops grown on land under a given set of climatic conditions is governed to a large extent by the chemical condition of the soil.

Further studies of the nature of nitrification, K. Miyake and S. Sōma (*Jour. Biochem., 1 (1922), No. 1, pp. 123–127*).—In a contribution from the Hokkaido Imperial University of Sapporo, Japan, studies of the nitrification of ammonium sulphate in soils are briefly reported. These indicated that the process of nitrification as a whole is an autocatalytic monomolecular chemical reaction, and that the increase of nitric acid in the process is in accordance with the formula

$$log\ x - log\ (A-x)=K(t-t_1)$$

The process of the diminution of ammonia compounds from the soil is also an autocatalytic chemical reaction, and the decrease of ammonia nitrogen is expressed in the formula

$$\frac{\log (A-x)}{\log (x-a)}=(A-a)Kt-K_1$$

In these formulas x is the amount of nitrogen in the form of ammonia at the end of time t, and A and a are, respectively, the original and final amounts of ammonia. K and K_1 are constants.

The washing out of nitrate and ammonia nitrogen from sand and loam soils, W. Geilmann (*Jour. Landw., 70 (1922), No. 4, pp. 259–266*).—Studies conducted at the University of Göttingen on the leaching of nitrates and ammonia from sand and loam soils are reported.

Considerable differences were found in the amounts of seepage water and nitrogen leached from the sand and loam soils. The nitrogen content of the seepage water from sand soil, corresponding to the nitrate fertilization of that soil, was very rapidly removed. Ammonium sulphate was removed much more slowly from this soil. Nitrogen in general was removed from loam soils much more slowly than from sand soils, and no great differences were observed in the amounts of nitrate and ammonia nitrogen removed. It is noted that about 7 per cent more nitrogen was washed out of loam soil with ammonium sulphate than with sodium nitrate.

Sulphur content of soils and its relation to plant nutrition, S. V. Eaton (*Bot. Gaz., 74 (1922), No. 1, pp. 32–58, fig. 1*).—Studies conducted at the University of Chicago on the sulphur content of soils in the eastern and central United States, and on the relation of sulphur to chlorophyll development in certain plants and its effect on their yield, are reported. The phosphorus content of the soils studied was also determined.

Soils from Alabama, Maryland, and Oklahoma were found to be deficient in sulphur, phosphorus, and organic matter. The phosphorus content was not much greater than that of the sulphur. The Central States soils were better supplied on the average with all three materials, and decidedly better with phosphorus. Soils from Chicago had a fairly good content of phosphorus and a rather high content of sulphur and organic matter. Most of the soil sulphur was found to be in the organic form. There was a general correlation between the sulphur and organic matter content, soils of a high organic matter content generally having a high sulphur content. The surface soils usually contained more sulphur than the subsoils.

These results, together with those obtained by others, are taken to indicate that sulphur fertilization should prove quite generally beneficial on the Atlantic and Gulf coasts, but is not as generally needed in the Central States.

Attempts are made in the case of several soils to correlate the sulphur, phosphorus, and organic matter contents with the productivity of the soils, previous treatment, or other factors. No definite conclusions were drawn from the data as to the relation of sulphur to chlorophyll development in plants.

Flowers of sulphur and sodium sulphate, containing the same amount of sulphur as 100 lbs. of gypsum per acre, and gypsum at the rate of 500 lbs. per acre caused increased dry weights of sweet corn of from 35 to 66 per cent. Larger additions of flowers of sulphur and sodium sulphate gave no increases. Sulphur apparently increased the moisture content of corn, in the case of gypsum by 5 per cent.

A list of 28 references to literature bearing on the subject is appended.

The effect of lime and organic matter on the so-called hardpan subsoils, M. A. Beeson and H. F. Murphy (*Oklahoma Sta. Bul. 143 (1922), pp. 7*).—Studies to determine methods of breaking up tough, clayey hardpan subsoil so that alfalfa roots can penetrate it are reported.

Organic matter was found to increase the water-holding capacity of the soil mostly in the first foot section. Lime increased the water-holding capacity in both the first and second foot sections. Manure had the greatest effect in lessening the resistance to penetration in the first foot, while lime decreased the resistance to penetration in the second foot. Lime increased the yield of alfalfa, but manure caused the greater increase. The greatest beneficial returns both as to the physical condition of the soil and increases in yields resulted from the use of both lime and manure.

With no treatment root development was limited mostly to the soil above the stiff clay hardpan. Where lime was applied the alfalfa roots entered the hardpan but did not pass through. Where manure alone was used the roots extended through the hardpan. The greatest depth of root penetration and greatest root development occurred where both lime and manure were applied. In this case the taproots extended below the hardpan subsoil into the more porous lower subsoil.

[Green manuring studies at the Mississippi Station], C. F. Briscoe (*Mississippi Sta. Rpt. 1922, pp. 17–19*).—Studies to determine the limit to the amount of green manure that can be turned under and still produce an increase of crop showed that the limit is between 40 and 60 tons per acre. Where

lime was added a larger yield was obtained in all cases. This is taken to indicate that acidity is one of the factors causing the decrease where large amounts of green manure are used.

Sulphur as an oligodynamic substance, E. Rosetti (*Italia Agr., 60 (1923), No. 3, pp. 116–119, figs. 2*).—In a continuation of studies previously noted (E. S. R., 48, p. 24), a repetition of the previous experiments to determine the influence of fall and spring applications of sulphur to crops is presented. Sulphur exerted a positive action on legumes. No difference was observed in the action of sulphur when applied in the spring and the fall. Apparently the main action of sulphur resulted from the formation of sulphuric acid, which rendered the soil potash and phosphoric acid soluble.

Theoretical and practical basis for carbon-dioxid fertilization, H. Lundegårdh (*Angew. Bot., 4 (1922), No. 3, pp. 120–151, figs. 4; abs. in Jour. Soc. Chem. Indus., 42 (1923), No. 8, pp. 153A, 154A*).—This is a progress report of studies begun in 1921 in Sweden on the fundamental principles and practical aspects of fertilization of crops with carbon dioxid.

Due to the established fact that the nutrition and yield of different crops depend to a considerable extent upon the concentration of the carbon dioxid in the air surrounding the leaves, it is concluded that different fertilization practices always influence the carbon-dioxid factor. Profitable applications of fertilizer have been found to influence the concentration of carbon dioxid as much as 28 per cent. The assimilation of carbon dioxid by leaves has been found to be directly proportional to its concentration in the air.

Somewhat contrary to the findings of others, the author has found that the use of artificial fertilizers alone can bring about an active production of carbon dioxid without the use of stable manure. In fact, the most marked production of carbon dioxid took place in experiments with oats treated with commercial fertilizers only. It was found that, while stable manure supplied both humus and bacteria to the soil, the normal soil itself usually contained enough of these materials to cause sufficient carbon-dioxid production when otherwise properly treated. It is concluded that stable manure has a specific action in this respect only when the soil is deficient in soluble humus. However, it is stated that stable manure contains the carbon-dioxid factor in concentrated form, and that its importance when used in large applications in the more extensive cultural operations should not be overlooked.

In this connection it has been found that very large applications of manure and fertilizers, while favorable to carbon-dioxid production, have a tendency to raise soil fertility conditions above the optimum, thus reducing the profitable growth of certain crops. It is believed that the carbon-dioxid factor can be increased without unduly increasing the nutritive value of the soil by different preliminary treatments of the stable manure and by the use of proper methods of introducing it into the soil. Studies of the soil atmosphere after deep and shallow incorporation of stable manure and horse manure showed that in the beginning the shallow incorporation resulted in the greater production of carbon dioxid. After a month's time, however, there was little difference in the results obtained with deep and shallow incorporation. It is concluded that the carbon-dioxid factor depends to a certain extent at least upon the quantity and quality of fertilizer used, and that analyses of soils for fertility constitutents should include analyses of the soil atmosphere for carbon dioxid.

It is pointed out further that the direct application of carbon-dioxid gas to crops has quite definite parctical limitations owing to the large amount of the gas required in crop nutrition.

The American fertilizer handbook (*Philadelphia: Ware Bros. Co., 1922, 15. ed., pp. [464], figs. 15*).—This number of this handbook contains the usual reference and directory of the commercial fertilizer industry and allied trades, together with a number of special articles and reports on related subjects. Important among the latter is an article on A Dictionary of Fertilizer Materials, by T. C. Pinkerton.

[Michigan fertilizer inspection in the spring of 1922], J. A. DOELLE (*Mich. [Dept. Agr.] Fert. Bul., 1922, pp. 42, figs. 5*).—This bulletin contains the text of the Michigan fertilizer inspection law, a list of fertilizer manufacturers, brands of fertilizer licensed for sale in Michigan during 1922, and actual analyses of 811 samples of fertilizers and fertilizer materials collected for inspection during the spring of 1922, of which 209 were found to be deficient in one or more ingredients.

Fertilizer registrations for 1923, C. S. CATHCART (*New Jersey Stas. Bul. 382 (1923), pp. 5–22*).—The usual list of the brands of fertilizers and fertilizer materials registered for sale in New Jersey for 1923 is presented.

AGRICULTURAL BOTANY.

The behavior of stomata, J. V. G. LOFTFIELD (*Carnegie Inst. Wash. Pub. 314 (1921), pp. 104, pls. 16, figs. 54; rev. in Science, 57 (1923), No. 1475, pp. 418–420*).—A report is given of investigations undertaken to discover what changes take place in the apertures of stomata throughout the day and night, the influence of physical factors upon such changes, and the final effect upon transpiration, various important crop and other plants being investigated. A modification of the method used by Lloyd (E. S. R., 20, p. 525) was employed in these studies.

The daily march of stomatal movement was found to vary from day to day, and it was seldom the same on two consecutive days. This variation appears to be correlated with changes in weather, water content, etc. In nearly all the plants examined stomatal opening was correlated with the presence of light when conditions were favorable. On a few plants light seemed to play little or no part on stomatal opening.

The plants investigated were found to fall in three groups: Cereals, in which night opening does not occur under ordinary conditions; thin-leaved plants, such as alfalfa, in which, under favorable conditions, the stomata are open all day and closed at night; and the third group, represented by the potato, in which the stomata are more or less open all day and night under optimum conditions. The stomatal movement of each plant studied was found to follow a regular course under optimum conditions, being modified by unfavorable environment.

It is claimed that light induces the opening of stomata after daybreak by initiating the conversion of the starch within the guard cells into sugar. This increases the osmotic pressure of the guard cells and in turn results in the opening. The temperature of the air, if within the limits of the functioning of the protoplasm, affects the speed at which stomata open during the morning. When the temperature of the soil rises too high the stomata close, and in extreme cases the plants wilt. Water-logged soil was found to act in the same manner by inhibiting the functions of the roots.

The author states that no atmometer or evaporimeter was found that would measure at all accurately the effect upon the plant of all the factors concerned in evaporation. He further questions Lloyd's evidence that stomata are nonregulatory, as it is claimed that the evidence was based on the use of potom-

eters to measure water loss. It is said that although the factors concerned in evaporation have great influence upon transpiration, this influence is definitely controlled by the stomata.

Experimental researches on vegetable assimilation and respiration.—XIV, Assimilation by submerged plants in dilute solutions of bicarbonates and of acids: An improved bubble-counting technique, A. J. WILMOTT (*Roy. Soc. [London], Proc., Ser. B, 92 (1921), No. B 647, pp. 304–327, figs. 18*).—The procedure of counting the bubbles given off from the cut stem of a submerged water plant to obtain a measure of the magnitude of the plant's assimilation, said to have been introduced by Dutrochet in 1837 and matured by Sachs in 1864, has been of great use in demonstrations and class work, and has also been seriously employed in a number of researches, though from time to time subjected to a good deal of criticism, as giving a faulty measure of the true rate of photosynthesis.

The first part of the present paper describes a simple device which, it is claimed, removes at once two of the very serious defects of the method, and renders it much more suitable for research work. The second part applies this method to an elucidation of the extraordinary effect of dilute mineral acids upon bubble rate brought forward by Treboux (E. S. R., 15, p. 651). In the third part the relation of bubbling in bicarbonates to bubbling in carbonic acid is investigated, and it is claimed that Angelstein's statement[1] that water plants can actively split bicarbonates in solution is erroneous.

Cytology of chlorophyll types of maize, L. F. RANDOLPH (*Bot. Gaz., 73 (1922), No. 5, pp. 337–375, pls. 6*).—The present study was undertaken for the purpose of determining whether or not there are in the cells of certain chlorophyll types of maize any visible structural differences which can be shown to be responsible for, or correlated with, the known genetic behavior of these plants.

The chlorophyll types here described do not include all the known cases of chlorophyll abnormality in maize, but have been selected as representative of certain distinct categories, illustrating markedly different kinds of behavior, both in development and in inheritance. These types are discussed in genetical literature as "normal green," "Mendelian white," and "Mendelian virescent." The "maternal inheritance strain," discovered by Anderson, has not yet been described in the literature.

All the chlorophyll types examined were found to contain the same initial cell structure, minute "proplastids" of the same size and general appearance being present in every type.

In normal green plants the proplastid first appears in the cell as a minute granule at the limit of visibility, gradually enlarging and developing chlorophyll until it becomes a mature chloroplast. In plants of the other chlorophyll types studied (Mendelian white, Mendelian virescent, and the maternal inheritance strain) the unusual characters of the plants are due to the failure of the proplastids initially present to develop into plastids with the normal size, or color, or both.

The green and colorless plastids found in different plants or in different portions of the same plant do not represent two fundamentally distinct types, but are rather to be regarded as the end members of a continuous series which comprises also all intermediate conditions. No cytological evidence was found favoring the view that the primordia from which the variously developed plastids arise are of more than one kind.

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[1] Beitr. Biol. Pflanz., 10 (1911), pp. 87–117.

Partially developed and fully matured plastids may be seen multiplying by division, but when first visible the proplastid is so minute that it is impossible to determine the mode of its origin. The division of partially mature and mature plastids emphasizes the fact that they have a distinct individuality at such stages, but in view of the obscurity which surrounds the origin of the minute primordia from which the plastids first appearing in the embryonic cells arise, the question regarding the extent to which the plastids are to be considered permanent cell organs with an unbroken genetic continuity throughout the life cycle must remain an open one.

In the case of those strains in which the inherited characters are transmitted according to Mendelian rules, it is inferred that the behavior of the proplastid is at least in part under the control of the nuclear mechanism. In those strains in which the inheritance of the unusual characters is non-Mendelian (maternal strains), it is very probable that an explanation of another kind will be found necessary.

The relation of age to size in certain root cells and in vein islets of the leaves of Salix nigra, M. A. TELLEFSEN (*Amer. Jour. Bot., 9 (1922). No. 3, pp. 121–139, figs. 3*).—Black willow was chosen for this work because of its abundance locally, its marked ability to reproduce vegetatively as well as sexually, and the comparative readiness of the specialized tissues, as roots, to develop from meristematic tissue under laboratory conditions. The treatment and responses of the material are detailed.

Cuttings from younger trees of *S. nigra* rooted in less time than did those from older trees, and leaves appeared earlier on the cuttings of the younger trees. Age thus appears to be correlated with a decrease in growth rate. The number of xylem strands coincides with the number of large cortical air spaces. Epidermal and cortical root cells of cuttings seem to become smaller, though xylem and meristematic root cells of cuttings seem to become larger with the increasing age of the parent tree. Endodermal and phloem root cells tend to decrease in size through their tangential diameters and to increase in size through their radial diameters. The age of the parent tree apparently affects the size of root cells of cuttings. The average area of leaf-vein islets from older trees is smaller than that from younger trees. Large air spaces, averaging four in number, were found in the cortical tissue of the willow roots.

Studies on relations in the Ericales and germination in the Pyrolaceae, H. CHRISTOPH (*Bot. Centbl., Beihefte, 38 (1921), 1. Abt., No. 2, pp. 115–157, pl. 1*).—In portions of this abbreviated account of studies (dealing mainly with *Calluna vulgaris* and *Erica carnea*), which are said to have been reported in full in a Munich dissertation, the author deals critically with data and views set forth by Ternetz (E. S. R., 19, p. 425) and by Rayner (E. S. R., 33, p. 221), presenting conclusions from his own researches. The development of seedlings is dependent upon a number of factors, some external and difficult to supply in artificial cultures.

Mycorrhiza in the Ericaceae, M. C. RAYNER (*Brit. Mycol. Soc. Trans., 8 (1922), pt. 1–2, pp. 61–66*).—A critical review is given of the paper by Christoph, above noted.

Orchid mycorrhiza, J. RAMSBOTTOM (In *Orchids. Sussex, Eng.: Charlesworth & Co., 1922, pp. II+XVII, pls. 6; also in Brit. Mycol. Soc. Trans., 8 (1922), pt. 1–2, pp. 28–61, pls. 6*).—A systematic review of observation and experimentation of orchid mycorrhiza summarizes in addition portions of the report by Christoph, referring also to that by Rayner (both noted above). With regard to the question of infection of the seedling root from the capsule, it is considered obvious that there is considerable discrepancy between the account of Rayner

and that of Christoph and that until the results of one or other of these workers are confirmed it is not possible to draw from them theoretical conclusions.

Developmental selection in vascular plants, J. T. Buchholz (*Bot. Gaz., 73 (1922), No. 4, pp. 249–286, figs. 28*).—The process of developmental selection is a normal event or succession of events in the life cycle of vascular plants, in which it assumes various forms, being represented chiefly by embryonic, gametophytic, and gametic selection.

Developmental selection differs materially from natural selection, germinal selection, the intraselection of Roux, and other selection theories.

Records of conspicuous cases of polyembryony in ferns are brought together. Original studies are added, constituting, it is claimed, definite evidence that a selective plurality of embryos may normally exist even in the leptosporangiate ferns. Nearly all living ferns seem to undergo embryonic selection, or show evidence of having passed through a stage in which embryonic selection was the normal condition. The embryonic selection represented by the polyembryony of gymnosperms was derived from an embryonic selection habit in their fern ancestors.

Developmental selection in gymnosperms and angiosperms is represented not only by a selection among embryos, but also by a selection between female gametophytes and the male gametophytes represented by the pollen tubes. A form of selection intermediate between natural selection and developmental selection may be recognized in the competition between buds and branches of a sporophyte or a branching thallus. Developmental selection is a process which brings into play a definite internal competition between embryonic diploid individuals, as well as between the haploid sperms of fern plants, and the haploid male and female gametophytes of gymnosperms and angiosperms. On the other hand, natural selection usually acts on the diploid generation in these plant groups, or on the haploid fern gametophytes, where selection may take place in the external environment.

The discussion seeks to show why the process of developmental selection is not open to the more serious objections which have been urged against natural selection, and on what basis it equals or excels the latter as an effective selective process. The discussion also shows how developmental selection may account for some of the phenomena of orthogenesis on a mechanical basis. Developmental selection is not responsible for the origin of the chromosomal or other intracellular phenomena involved in mutation, but it is a powerful mechanism whose censorship may determine whether or not any particular intracellular phenomena causing mutation may complete the life cycle to be heritable, and therefore recognizable as a mutation.

The extent of natural cross-pollination in soy beans, C. M. Woodworth (*Jour. Amer. Soc. Agron., 14 (1922), No. 7, pp. 278–283*).—Natural hybrids are shown to occur in the soy bean. In a total of 205 seeds from recessive white-flowered plants, none proved to be hybrid. When cotyledon color was used as an index of hybridity, only three pods in a total of 7,480 contained hybrid seed. If all ways in which crossing may occur are taken into account the proportion would be 1 hybrid pod in 625, or 0.16 per cent. The percentage of cross-pollination may presumably differ according to the variety, the locality, and the season. Hybrids may also arise by mutation.

It is important to the experimental plant breeder and to the farmer to know how much natural crossing may be expected under given conditions.

Cyclic manifestation of sterility in Brassica pekinensis and B. chinensis, A. B. Stout (*Bot. Gaz., 73 (1922), No. 2, pp. 110–132, figs. 7*).—The various types of sterility seen in *B. pekinensis* and *B. chinensis* are held to indicate a mutually limiting relationship between vegetative and reproductive vigor.

Their irregular inheritance, their appearance at definite periods in the cycle of development of the plant as a whole, and especially the cyclic manifestation of self-compatibility, indicate that the morphological and physiological differentiations of sex are regulated and determined by those internal and biogenetic processes which in general determine the cycle of growth, development, and maturity in the life of the individual.

Keys to woody plants, W. C. MUENSCHER (*Ithaca, N. Y.: [Author], 1922, pp. 64*).—This little guide is intended, first, to aid the beginner in identifying some of the more common woody plants in the summer or winter condition, and secondly, to familiarize the student with descriptive terms and the use of keys and teach him what to look for and how when examining a woody plant, or a part of it, with a view to its identification. The aim has been to point out, as far as possible, diagnostic field characteristics, exclusive of flowers. Free use has been made of sources of information.

The keys are based upon the common woody plants of the eastern United States that occur native or planted in central New York, and in addition a few of the more commonly planted exotics of the same region.

The nomenclature used is in accord with the rules adopted by the International Congress of Botanists in Vienna in 1905 and in Brussels in 1910. A complete list of all the species is appended, in which the orders, families, and genera follow the systematic arrangement of Engler and Prantl. The species are arranged essentially as in Gray's Manual.

Inventories of seeds and plants imported by the Office of Foreign Seed and Plant Introduction (*U. S. Dept. Agr., Bur. Plant Indus. Inventories Nos. 64 (1923), pp. III+99, pls. 8; 65 (1923), pp. III+96, pls. 6, fig. 1*).—These inventories, which cover the period from June 1 to December 31, 1920, include more than 1,650 importations, a large portion of which were secured by H. L. Shantz in British East Africa, W. Popenoe in Central America, and J. F. Rock in Eastern Asia.

FIELD CROPS.

[Field crops work at the Alaska Stations], C. C. GEORGESON, F. E. RADER, G. W. GASSER, C. S. HAHN, and W. T. WHITE (*Alaska Stas. Rpt. 1921, pp. 13, 14, 16–21, 24–29, 30, 31, 34–43, 45, pls. 4, fig. 1*).—Experimental work reported in continuation of earlier investigations (E. S. R., 47, pp. 526, 527), includes comparisons of potato seedlings at Sitka; varietal studies with winter rye, winter and spring wheat, oats, barley, potatoes, and mangels, and plat tests of alfalfa, alsike clover, Hubam sweet clover, rutabagas, sugar beets, and carrots at Matanuska; varietal studies with oats, barley, spring wheat, alfalfa, potatoes, sugar beets, and tobacco, a fertilizer trial with potatoes, plat tests of turnips, rutabagas, and buckwheat, and studies in cooperation with the Bureau of Plant Industry, U. S. D. A., to determine the possible effect of prolonged daylight on the growth and flowering of soy beans and tobacco at Fairbanks; varietal studies with winter rye and spring wheat, oats, barley, and potatoes, and plat tests of peas, alfalfa, vetch, clover, hemp, and flax at Rampart; and observations on the value of native grasses on Kodiak Island for hay and silage.

[Report of agronomic work at the Guam Station, 1921], J. GUERRERO (*Guam Sta. Rpt. 1921, pp. 8–22, pl. 1, fig. 1*).—Experiments with field crops are reported in continuation of earlier work (E. S. R., 46, p. 725). Yields and other agronomic data are tabulated from the results of varietal trials with sorghums, velvet beans, cowpeas, pigeon peas, mungo and other small beans,

soy beans, peanuts, cotton, cassava, rice, taro, sweet potatoes, sugar cane, and tobacco.

A test at Cotot showed that when Para grass is not kept down the young coconut trees become stunted, but that where it is not allowed to encroach upon the root zone of the trees they make a fairly good growth. Intercropping young orchards with Para grass is not to be generally recommended. Experiments carried on at Cotot with Paspalum demonstrated that plantings started with root divisions stand more heavy and continuous pasturing, especially during the dry season, than do those propagated from stem cuttings. The benefit derived from the former method more than justified the extra labor involved. Notes are included on Guinea grass, Sudan grass, Guatemala grass, Japanese cane, Napier grass, *Pennisetum setosum*, and ragi.

In a cooperative test of legume cover crops for coconuts, the Patani beans were most efficient in keeping down weed growth in a given space, although the velvet beans spread over a greater area. The Patani beans also covered the ground efficiently for a greater length of time than the other crops. Most of the small bean varieties planted in time to mature during the dry season yielded considerably more grain than they did when the crop matured in the rainy season. However, the plants growing during the rainy season were larger and more vigorous than were those maturing in the dry season. No differences were apparent in the manner of growth of peanut vines produced from seed and those grown from cuttings. The native peanuts made the largest forage and seed yields from cuttings and Chinese varieties the largest yields from seed.

Where seven varieties of taro were planted on both lowland and upland, constant flooding sufficient to submerge about one-quarter of the entire plant was not conducive to good growth in the lowland plats, the best results being obtained with just enough water to keep the soil moist.

Acre application of ammonium sulphate 200 lbs., acid phosphate 166.5 lbs., and potassium sulphate 95 lbs. give highest yields in fertilizer tests with rice.

[Report of field crops work in Kansas, 1920–1922] (*Kansas Sta. Bien. Rpt. 1921–22, pp. 9, 10, 29–32, 35, 36*).—The continuation of experiments with field crops is reported as heretofore (E. S. R., 46, p. 434). Grain and fodder yields of grain and forage sorghums at Tribune Substation are tabulated.

Cooperative tests throughout the State disclosed the following varieties to be foremost: Kanred wheat, Kanota oats, Pride of Saline corn in general, Shawnee White and Commercial White on the better corn soils in the northeastern and southeastern parts of the State, respectively, and Midland Yellow Dent in the southeastern quarter. Sunrise kafir excelled as a combination grain and forage variety; for grain alone standard Blackhull was first in the eastern half of the State, and farther west Dawn, Pink, and Sunrise kafirs and the milos gave better results. Profit followed the use of fertilizers on wheat in the three tiers of counties along the east end of the State, but west of this section fertilizers did not generally produce an increase. Farm manure, acid phosphate, and bone meal gave the best returns. Increased yields of alfalfa were secured from fertilizers in the eastern part of the State where moisture was sufficient late in the season.

Outstanding results to date from cultural treatments in bindweed eradication experiments at the Fort Hays Substation were obtained from the July 1 seeding of continuously grown sorghum and from rotations of sorghum and fallow. The three months of intensive fallow before seeding appeared to accomplish more in eradicating the weed than did the growth of sorghum. Continuous intensive fallow eradicated bindweed with 20 operations the first

year and about 10 the second. On fallowed land it is necessary to keep the weeds cut off every time they appear. Salt proved feasible as a quick means of eradicating bindweed on small spots, but seems desirable only on areas to be sacrificed to prevent the spread of the weed. Quantities of salt less than 20 tons per acre were unsatisfactory, and even as much as 20 tons did not completely eradicate the bindweed. Borax did not seem to be more effective than common salt ton for ton during the first year, but in the second year, 1922, no bindweed plants appeared on the areas treated in 1921 with as much as 4 to 6 tons of borax per acre.

[Report of field crops work in Mississippi, 1922], J. F. O'KELLY, E. B. FERRIS, C. T. AMES, G. B. WALKER, and C. B. ANDERS (*Mississippi Sta. Rpt. 1922, pp. 13, 14, 34, 35, 41–44, 46–52*).—The continuation of earlier work (E. S. R., 47, p. 227) is reported. Experiments at the substations, which have been largely described from other sources, included variety and fertilizer tests with cotton at the South Mississippi Substation (E. S. R., 49, p. 330); variety and fertilizer trials with cotton, corn (E. S. R., 49, p. 222), and alfalfa, and pasture studies at the Holly Springs Substation; breeding work, variety, cultural, and fertilizer tests with cotton (E. S. R., 49, p. 225) and corn, and varietal and breeding work with oats at the Delta Substation; and variety tests with cotton, corn (E. S. R., 49, p. 225), sweet potatoes, sorghums, soy beans, and cowpeas, and fertilizer trials with cotton at the Raymond Substation.

In cultural tests at the station, yields of corn increased with the depth of cultivation, with each increase in the number of cultivations from 2 to 8, and with increase in spacing from 1 to 3 ft. Corn planted on a level, well-prepared seed bed outyielded corn planted under a ridge and on a ridge in the order named. Notable among the varieties were Hastings oats, Gooseneck sorghum, hairy and smooth Peruvian alfalfa, Black Unknown and Taylor cowpeas, and Otootan and Mammoth Yellow soy beans.

[Report of field crops work in Oklahoma] (*Oklahoma Sta. Rpt. 1922, pp. 6–10*).—The progress of previous work (E. S. R., 47, p. 823) is reported. Outstanding among the varieties were Fulghum oats, Abruzzi rye, an Oklahoma selection of winter barley, darso, and Blackhull White kafir among grain sorghums and Sumac and Orange of the sweet sorghums, and Oklahoma Triumph 44 cotton.

Continuous wheat, receiving from 8 to 10 tons of barnyard manure every 4 years, has averaged 20 bu. per acre annually during 30 seasons, and the soil of the plat had a higher moisture content than on an unfertilized plat which made only about 13 bu. per acre during the period. In the fertility tests with cotton, only acid phosphate at the rate of 125 lbs. per acre and barnyard manure have been found beneficial on the upland soils.

Drilled Sudan grass yielded more hay of superior quality than row plantings. The most productive rates were 8 lbs. in the row and from 19 to 30 lbs. drilled, and the optimum planting period appeared to be the latter half of April.

Cultural tests showed that sweet clover should be planted in the spring, preferably from February to April, and that the seed bed should be well prepared and firmed or settled when planted. Shallow planting has given better stands than deeper plantings. Biennial sweet clover made larger yields at a lower cost and had a greater pasture value than annual sweet clover.

[Report of field crops work in Texas, 1921] (*Texas Sta. Rpt. 1921, pp. 15–17, 19, 20, 22, 23, 24, 25–30, 31, 32–37, 38, 39–41*).—Experiments with field crops conducted at the station and substations and reported in summary form in continuation of previous work (E. S. R., 46, p. 328) include variety and

cultural tests with corn, cotton, cowpeas, oats, wheat, barley, rice, broom corn, grain, and forage sorghums, peanuts, and alfalfa; variety trials with edible beans, hemp, and potatoes; fertilizer tests with rice; breeding work with cotton, oats, rice, wheat, and grain sorghums; comparisons of seed potatoes and cotton from several sources; rotations involving many of the foregoing crops; intertillage studies with corn and cowpeas; and field trials with black medic, sweet clover, guar, and miscellaneous legumes and grasses. Much of the work was in cooperation with the Bureau of Plant Industry, U. S. D. A.

Results in a study of spacing and time of thinning of cotton indicate that late thinning is harmful rather than beneficial and that with adequate moisture supply and cultivation and absolute freedom from competing weeds and grasses, cotton may be left much thicker in the row than usual. Many of the best yields were secured with spacing from 6 to 12 in. apart in 3-ft. rows. Observations at Spur showed that hail-damaged cotton plants, with from 2 to 4 fruiting branches and with green buds in the axils of the leaves, could be partially saved when cultivated as soon as possible after the hail. Of those plants cultivated immediately after the hail, 22 per cent survived and produced fruit. All young cotton plants not yet branched died whether cultivated or not. The value of home-grown cottonseed was demonstrated at several points.

Wisconsin seed outyielded Nebraska Irish potatoes, and unirrigated Nebraska seed made uniformly higher yields than seed grown under irrigation.

Rice receiving ammonium sulphate alone has averaged highest in fertilizer tests at Beaumont. When the fertilizers were applied to the growing crops weeds were not so detrimental to yields as with applications at planting.

Cultivation tests with several crops gave indications that the presence or absence of weed growth is probably a greater factor than the exact nature of the soil mulch obtained.

Plowing has given the highest yields as a preparation for planting sorghum for forage at Spur. The largest yields of milo were from ground worked 3 in. deep in October, and plowing was better than listing or disking. In kafir inbreeding and headtype studies at Lubbock, a selection with short seed branches gave the highest acre yield, 71.8 bu., while a selection for few seed branches made the lowest average, 55.2 bu. No evidence that an abnormal spur at the base of the kafir head is transmitted to the progeny was obtained. Natural cross-pollination in grain sorghums ranged from 0.33 to 2.98 per cent, averaging 1.67 per cent. Hybrids between Blackhull Kafir and Red Kafir showed the Red Kafir type and shape of head to be dominant, while the color of the seed was intermediate. From 5 to 8 per cent of shrinkage was observed in well-matured grain sorghum heads beginning to turn yellow and in proper condition for heading, and as much as 25 to 35 per cent in immature heads. In a rotation of grain sorghum with cotton, feterita continuous manured for a period of years averaged 32 bu. per acre, feterita continuous 27, feterita after cotton 35, and feterita after cotton manured, 30 bu.; cotton continuous manured, 285 lbs. of lint, cotton continuous 253, cotton after feterita 265, and cotton after feterita manured 220 lbs. Although yields were lower, a like trend was noted in a similar rotation at Spur.

[Report of the Wyoming Station] agronomy department, A. F. Vass (*Wyoming Sta. Rpt. 1922, pp. 145, 146*).—The yields of potatoes have been almost doubled after alfalfa in rotation experiments. The grains following potatoes outyielded grain after grain, and the yields on potato ground were almost equal to those on summer fallow. The thicker rates and earlier time of seeding have given the best results with sunflowers. Prominent among the varieties were Kubanka durum wheat, Silvermine and Golden Rain oats, California Feed and Odessa barleys, and Pearl and King potatoes.

Experiments with alfalfa and grasses at the Judith Basin Substation, N. F. WOODWARD (*Montana Sta. Bul. 152 (1923), pp. 24, figs. 7*).—Experiments with forage crops at the Judith Basin Substation, in cooperation with the Office of Forage-Crop Investigations, U. S. D. A., are reviewed.

Although cultivated alfalfa yielded slightly more hay per acre than the uncultivated plats, the increases were generally within the limits of experimental error and were hardly sufficient to pay the cost of cultivation. Yield differences between variegated alfalfa and the hardier strains of the common group are not considered an important factor in selecting an alfalfa for the region, but where the crop is subject to winter-killing, preference should be given to variegated alfalfas such as Grimm or Cossack, which as a rule are more resistan to cold and drought than the common strains. Seeding trials recommend sowing 10 lbs. of seed per acre on a satisfactory seed bed as early in the spring as weather and soil conditions will permit. Weedy land should be cultivated thoroughly immediately before seeding to alfalfa. In ordinary years seeding alfalfa with a nurse crop is not considered a safe practice, but if available moisture is plentiful during April, May, June, and July, the nurse crop will not materially affect the alfalfa. Alfalfa in rows 30 in. apart gave the highest average yield of hay during the test, but 36 to 42-in. rows are preferred. It is pointed out that in extremely dry seasons, alfalfa in rows will produce more hay than that which has been broadcasted or close-drilled. Alfalfa alone made slightly more hay per acre than an alfalfa-brome grass mixture.

Harvesting alfalfa for seed or allowing it to remain unharvested rather than cutting for hay every year increased the vigor of the plants slightly, but the yield increase was insignificant. Clipping alfalfa during the season planted to control weeds did not affect the yield in later years, but unclipped alfalfa started growth earlier in the spring. Alfalfa produced very little seed under any method of cultivation, but more was produced with plants in rows or hills than when close-drilled.

Crested wheat grass (*Agropyron cristatum*) seemed to be better adapted to the soil and climatic conditions than any other cultivated grass tested, producing good yields of both forage and seed. Brome grass, being both drought and cold-resistant, also gave promise as a dry-land grass, and, because of its palatability and early spring growth, is a very satisfactory pasture crop. Timothy did not yield well in Judith Basin.

Annual forage crops on dry land at the Judith Basin Substation, N. F. WOODWARD (*Montana Sta. Bul. 153 (1923), pp. 15, figs. 4*).—Investigations to determine the most profitable annual forage crops for dry-land conditions were carried on under conditions similar to the above.

Among the most promising varieties of field peas for the region are Carleton, McAdoo, Paragon, and Gregory. Based on variety and seeding trials, rates of 80 lbs. per acre are recommended with small seeded varieties, medium seeds 100 lbs., and large seeds 120 lbs. Field peas should be drilled early and covered from 2 to 4 in. deep. Paragon field peas and Swedish Select oats sown at the proportion of 60 to 40 lbs. per acre produced the most economical yield of hay over a 3-year period. This mixture gave only a slight increase over Swedish Select oats seeded alone at a 48-lb. rate. White Hull-less barley and Marquis wheat alone have also given promising hay yields.

Corn, outstanding among annual forage crops at this station (E. S. R., 43, p. 738), has produced an average of 4,730 lbs. of cured fodder per acre from 1909 to 1921, inclusive. Sunflowers made slightly more green forage per acre than corn during 1920 and 1921. Low yields and high labor needs preclude the extensive culture of root crops on dry land. Millet, sorgo, and Sudan grass were not dependable, and soy beans, vetch, and horse beans were valueless.

Wheat and flax as combination crops, A. C. Arny (*Minnesota Sta. Bul. 204 (1923), pp. 4–21, figs. 4*).—General information is given concerning the growing in combination of wheat and flax, together with the results of tests at the University Farm and experiences of farmers in Goodhue County, Minn.

Fair results were obtained from Marquis wheat and flax in combination, the average increase in yield during a 6-year period from each of 2 combinations amounting to 6.25 per cent. In only 1 of 12 tests during the period with Marquis wheat and flax did the yield of flax in a mixture equal the yield of flax grown alone under like conditions. Mixtures of Manchuria barley and of Improved Ligowa oats with Primost flax seeded at different rates per acre produced very unsatisfactory yields of flax and a lower average total yield than either of the crops grown alone. Two mixtures of Bluestem wheat and Primost flax made only moderate yields of flax, and the total yields per acre were not significantly greater than from the crops grown separately.

In values per acre based on December 1 farm prices, except during the period 1917–19 when the price of wheat was very high as compared with flax, the mixed crops averaged somewhat higher than the flax alone when only the seed yields are considered. When the farm value of the clear flax straw is regarded, the flax crop had as high values per acre as the mixed crops.

Among the advantages of growing the mixed crop are increased seed yields per acre, less trouble from weeds and diseases, and easier handling. However, the straw can not be used like clear flax straw for manufacturing purposes, and the grain usually must be separated before marketing.

A mixture of 15 lbs. of wheat to 28 lbs. of flax usually produces an excess of flax, whereas from 30 to 45 lbs. of wheat to 28 lbs. of flax averages as much or more wheat than flax in the harvested crop. A depth of 1 to 1.5 in. at the usual time for seeding wheat is indicated.

Fight the chinch bug with crops, W. L. Burlison and W. P. Flint (*Illinois Sta. Circ. 268 (1923), pp. 16, figs. 7*).—Soy beans, cowpeas, mangels, buckwheat, sunflowers, and rape are indicated as crops (E. S. R., 41, p. 60) on which chinch bugs will not feed, and cultural methods, field practices, and varieties are recommended in brief. Varieties of corn resistant to attacks of second-brood chinch bugs during July and August have been described earlier (E. S. R., 49, p. 330).

Fertilizers affect quality of alfalfa, O. B. Price (*Michigan Sta. Quart. Bul., 5 (1923), No. 4, pp. 158, 159*).—Application of limestone and acid phosphate increased the yields of alfalfa on light, sandy, acid soils in Manistee County and also the percentages of calcium and phosphorus in the hay. Land limed in 1920 and seeded in 1921 produced nearly twice as much alfalfa hay in 1922 with almost a doubled calcium content as land limed in 1921 and seeded the same year. Similar results were obtained from both the first and second cuttings, although yields were lower in the second.

Influence of spacing on productivity in single-ear and prolific types of corn, E. B. Brown and H. S. Garrison (*U. S. Dept. Agr. Bul. 1157 (1923), pp. 11, figs. 6*).—Varieties of both prolific and single-ear types of corn were grown at different spacings at Clarksdale, Miss., Waco and San Antonio (E. S. R., 47, p. 430), Tex., and Arlington, Va., to determine which type would show the greater adaptability as judged by its yield.

The prolific type was more productive than the single-ear type, and was more efficient in increasing the yield and the number of ears per plant. The single-ear type excelled in increasing the weight of ear. Adding to the number of ears per plant appeared to be more effective than did increasing the weight of ear in increasing the yield per plant. In sections to which both types are adapted the prolific would seem to be the more productive under the

conditions of general field culture because of its better adjustment to varying environment.

Pop-corn varieties, J. R. DUNCAN (*Michigan Sta. Quart. Bul., 5 (1923), No. 4, pp. 164–166, fig. 1*).—Varietal work at the station in cooperation with the U. S. Department of Agriculture is described briefly. Different objectionable features have relegated into the garden variety class all but a few varieties and strains. The leading varieties grown on a field scale ranked according to market value are White Hull-less, Amber Rice, White Rice, and Yellow Pearl. The transition of pop-corn culture from a garden to a field basis is considered due to the use of automatic popping machines and convenient retail packages of shelled grain.

Cotton variety tests, G. BRIGGS (*Oklahoma Sta. Bul. 141 (1923), pp. 3–15*).—Agronomic and yield data with estimated money values are tabulated and discussed for about 40 varieties and selections of cotton compared at the station from 1916 to 1921, inclusive. Results of the 1922 variety tests at the station are appended together with directions for growing cotton under boll-weevil conditions. Oklahoma Triumph 44 and Hartsville No. 12 have averaged highest in yields and value of seed and lint. When the varieties were ranked with first pickings as an index to earliness, Keenan, Half-and-Half, and Acala were foremost with 100 per cent of their entire crop harvested at the first picking, while Durango, Trice, and Simpkins led with the heaviest yields from first pickings.

Boll-weevil cotton in Texas, O. F. COOK (*U. S. Dept. Agr. Bul. 1153 (1923), pp. 20, pls. 4*).—Cotton plants infested by boll weevil early in the season, with destruction of most of the flower buds, grow more vigorously, attain a larger size, and exhibit a deeper green color than plants in normally productive fields, and also bear many sterile, defective involucres in the latter part of the season. As a result of the luxuriant growth, the fields of boll-weevil cotton are soon covered with a dense mass of foliage, the lanes are closed between the rows, and the ground is shaded continuously. Weevils breed in large numbers under such conditions, and larvae in fallen buds are protected by the shade of the overgrown plants instead of being killed by exposure to heat and dryness.

The behavior and production of well-fruited open plants in contrast with sterile crowded plants, observed at San Antonio, Tex., in 1921 in a season favorable for plant growth and production of a large cotton crop, showed the necessity of avoiding the rank growth and dense shade of the boll-weevil fields. Wider separation of the rows, combined with closer spacing of the plants in the row (E. S. R., 47, p. 429) is suggested as a means of restricting the size of the individual plants, keeping open the lanes between the rows, and avoiding the adverse condition of boll-weevil cotton. Although the best arrangement of rows under different local conditions has not been fully determined, it is indicated that the rows should not be less than 4 ft. apart, with plants not more than 6 in. apart in the rows. In the absence of other precautions in spacing, the cutting out of alternate rows might be advisable as an emergency measure, as demonstrated by the higher yields of the open rows and exposed plants that continued to set bolls late in the season in the San Antonio experiments of 1921.

The value of late thinning to suppress vegetative branches, combined with close spacing, is discussed, and a list of publications on weevil resistance and close spacing of cotton is appended.

Flax in Montana, 1923 (*Montana Sta. Circ. 113 (1923), pp. 3–7, figs. 7*).—Essentials in the culture of flax on breaking, on spring plowing and on summer fallow on old land, and on irrigated land are summarized. The present flax situation, 1923, is said to greatly favor an increase of flax acreage in the flax

region of Montana. The principal causes of failure in the State are drought, weeds, poor seed beds, and grasshoppers.

Oats—rotation v. continuous culture, H. F. MURPHY (*Oklahoma Sta. Bul. 145 (1922), pp. 8, figs. 2*).—During a 5-year period, continuous untreated oats have averaged 39.6 bu. of grain and 1,460 lbs. of straw per acre, continuous manured 45.7 bu. and 1,670 lbs., continuous with crop residues 43.4 bu., in rotation untreated 46.9 bu. and 1,804 lbs., in rotation manured 48.3 bu. and 1,737 lbs., and in rotation with crop residues 45.9 bu. Although the rotation check plats averaged 9.8 bu. less than the continuous check plats in 1917, they made 14.4 bu. more than the continuous checks in 1921. A similar trend was noted with the treated plats.

With the foregoing results as a basis, it is estimated that the inclusion in rotations of the 1,500,000 acres of oats grown annually in the State would net the farmers more than $4,000,000 over continuous cropping. Another $1,000,000 might be added yearly by using manure in connection with the rotation.

[Potato seed studies], E. P. SANDSTEN (*Colorado Sta. Rpt. 1922, p. 20*).—A study of degeneration of potato seed demonstrated that seed selection is necessary to maintain a high yield. It was also shown that knotty potatoes are not necessarily poor seed, and that the shape of ill-grown potatoes resulting from improper cultivation and irrigation is not transmitted through the seed and does not appear in the following crop. The results showed that potatoes grown in the high mountain sections and in the mountain valleys do not run out, the decline in yield being due to disease and to the planting of small and inferior seed.

Rice experiments at the Biggs Rice Field Station in California, J. W. JONES (*U. S. Dept. Agr. Bul. 1155 (1923), pp. 60, figs. 14*).—Cultural, irrigation, fertilizer, and varietal experiments with rice and studies of weed control, conducted in cooperation with the Sacramento Valley Grain Association, are described in detail, together with a brief review of rice growing in California and notes on environmental conditions at the Biggs Rice Field Station.

The highest average yield in depth-of-seeding experiments, 4,423 lbs. per acre, was obtained from a 2-in. depth. Shallow seeding was better than deep seeding. Whether rice was drilled or broadcasted, the highest averages were obtained from the heaviest rates of seeding, 100 lbs. from 1913 to 1917 and 150 lbs. from 1918 to 1921. Tests during 1921 with three varieties of rice indicated that 150 lbs. is probably the best acre rate on old rice land. In the date-of-seeding trials, a marked decrease in yield has been encountered with each successive date. The smooth seed bed made a slightly larger average yield than the rough seed bed. Rice under continuous cropping during the period, 1913 to 1919, has averaged 3,528 lbs. per acre.

Submerging 30 days after the rice emerged gave the highest average, 3,699 lbs. per acre, in time-of-submergence experiments, and submerging the land 6 in. deep during the submergence period made the best returns, 3,925 lbs., in depth tests. Slowly changing water gave a higher average yield than stagnant water, and fluctuation in the depth of submergence surpassed both treatments. Land kept moist but not submerged during the usual submergence period produced dwarfed plants, small heads, and low yields of poor quality. The best irrigation practice is said to consist of irrigating the rice as often as necessary until 30 days after emergence, and then submerging the land 6 in. deep continuously until the crop is ready to drain for harvest.

Fertilizer experiments during the period 1914 to 1916, inclusive, showed that manure increased the average yield 879 lbs., ammonium sulphate 651, dried blood 646, and cottonseed meal 583 lbs. per acre, the respective net values of the increases, amounting to $12.70, $9.09, $8.16, and $5.85 per acre.

Nonnitrogenous fertilizers seem to be unprofitable on Stockton clay adobe soil, whereas all nitrogenous fertilizers except sodium nitrate produced profitable increased yields. Combinations of the two groups of fertilizers did not increase the yields as much as when the nitrogenous fertilizers alone were applied, and were usually uneconomical. Since manure is too scarce and difficult to apply for commercial use, either ammonium sulphate, dried blood, or cottonseed meal may be used profitably on commercial rice fields in California.

Varietal tests indicate that the long-grain and medium-grain varieties are not well adapted, while the short-grain rices are well suited to California conditions, and constitute about 98 per cent of the rice grown in the State. Wataribune, a late maturing short-grain rice, yielded 4,364 lbs. per acre, the highest average yield in 9 years; Butte, a midseason short-grain variety, 3,456 lbs.; and Honduras, a long-grain late maturing variety, 2,600 lbs. Sue Hero was the leading variety or selection in the short-grain early group, with an average of 1,843 lbs.; in the midseason group Selection No. 1561–3 with 3,920 lbs.; and in the late group Selections Nos. 114 and 115, each with 2,995 lbs. In the same period Early Prolific, a medium-grain midseason variety, averaged 2,337 lbs., and Selection No. 113, a long-grain midseason variety, 2,612 lbs. Early rice varieties mature in from 135 to 154 days from the first irrigation, midseason varieties in about 161 days, and late varieties in 176 to 180 days. Early Wataribune, Colusa, Onsen, Caloro, and Late Wataribune, considered the leading commercial rice varieties in California, are among the varieties described briefly.

Methods of control for barnyard grass (*Echinochloa crusgalli* and varieties), the worst weed in California rice fields, consists of hand pulling, cultivation during fallow years, and continuous submergence from date of seeding until the rice crop is ready to drain. Other weeds (E. S. R., 49, p. 229) which are considered troublesome at times include scale grass, spike rush, cat-tails, umbrella plants, and canary grasses.

Beans, corn, grain sorghums, cotton, and hemp have not been grown successfully, principally due to a high water table when grown adjoining submerged rice land. Wheat and barley appear to be the best crops to rotate with rice. After growing rice, the land should be fallowed one summer before seeding to wheat or barley.

Wheat continuous with and without manure, M. A. Beeson (*Oklahoma Sta. Bul. 140 (1921), pp. 1–11, figs. 4*).—Continuous wheat, manured about every 4 years, averaged 22.63 bu. per acre during 23 years, whereas an unmanured continuous plat made 13.45 bu. The data show that the percentage of increase was greatest within the first 3 years after the applications of the manure. Because of the greater weight per bushel the grain from the manured plat also graded higher.

Although no relation seemed to exist between the annual rainfall and the wheat yield, the precipitation between October 1 and December 31, the autumn growing period, appeared to exercise a considerable influence on the wheat yield on the Kirkland type of soil. A decreased yield seemed to accompany an increased rainfall in June.

HORTICULTURE.

[Horticultural investigations at the Alaska Stations], C. C. Georgeson, H. Lindberg, F. E. Rader, G. W. Gasser, and C. S. Hahn (*Alaska Stas. Rpt. 1921, pp. 7–13, 14, 15, 21, 22, 29, 30, 31, 43, 44, pls. 3, fig. 1*).—This report, as in previous years (E. S. R., 47, p. 534), consists largely of the results of varietal and acclimatization tests with fruits, vegetables, and flowers.

Cruciferous vegetables, such as cabbage, cauliflower, kale, and Brussels sprouts, gave excellent results at the Sitka Station. Beets, particularly those varieties having globular roots, were fairly satisfactory, but very often were found to go directly to seed without forming an edible root. Lettuce, radishes, peas, and carrots are considered standard crops for Alaska, and certain perennials, such as horseradish and rhubarb, thrive when abundantly fertilized. Among small fruits, the currant, especially the variety Long Bunch Holland, was an unqualified success in 1921, the bushes being heavily laden with fruit. Strawberries suffered from the damp, cloudy weather during the fruiting period. Yellow Transparent, Liveland Raspberry, and Keswick were the only apple varieties to set an appreciable quantity of fruit, and this failed to ripen. The Siberian crab ripened sufficiently to make jelly and preserves. A cherry tree trained against a south wall matured a normal crop of fruit. Those ornamentals which are hardy in Alaska yielded an abundance of bloom. The Tartarian honeysuckle, Rugosa roses, and nearly all herbaceous perennials were very satisfactory. Plant-breeding operations consisted in crossing the wild *Fragaria platypetala* and Yakutat with hybrid strawberry seedlings previously developed at the station. Attempts to cross *Rosa nutkana* and *R. rugosa* failed on account of the dull weather conditions, which apparently caused a poor development of pollen.

At the Matanuska Station peas, beets, and carrots did exceptionally well. Red raspberry plants which had been bent over and covered with spruce boughs and straw bore abundantly. Strawberries were winter-injured, and even the gooseberry requires winter protection to succeed. Strawberries made a satisfactory growth at the Fairbanks Station, but failed to produce a normal crop. Native raspberries bore abundantly. Sweet peas, nasturtiums, and snapdragons were satisfactory flowers. At the Rampart Station unprotected Cuthbert raspberry plants produced a fair crop despite the freezing back of some of the canes. All the edible vegetables planted, including carrots, parsnips, lettuce, beets, cabbage, cauliflower, etc., were successful.

[Horticultural investigations at the Guam Station], J. GUERRERO (*Guam Sta. Rpt. 1921, pp. 23–26, fig. 1*).—Of various fertilizers tested on the Smooth Cayenne and Thorny pineapples, ammonium sulphate produced the largest yields of fruit. The Smooth Cayenne was the more prolific of the two varieties. Sucker plants produced their first ripe fruits in 162 days, as compared with 383 days for crown plants.

The Mignonette variety of lettuce, although low in yield, proved to be one of the best of several varieties tested. Selection with the Cristobal tomato during nine generations has resulted in a gradual improvement in the symmetry of the fruit. Observations upon coconut trees fertilized with ammonium sulphate and acid phosphate, used separately and in combination, indicated very little difference between the various treatments. Brief notes are given on the behavior of miscellaneous tropical fruits.

[Horticultural investigations at the Texas Station] (*Texas Sta. Rpt. 1921, pp. 6, 7, 23, 24*).—Brief reports are given of the various activities without including data.

A promising cross between the dewberry and red raspberry, hitherto known as the "A and M," has been renamed "Ness berry" in honor of the originator. Observations in a vineyard consisting of Vinifera varieties on their own roots and grafted on *Vitis champinii* indicated that the grafted vines are hardier and more fruitful. Studies in oak breeding, in which the live oak was crossed with the overcup, swamp white oak, and post oak, revealed an astounding variation in the second generation, ranging all the way between the original parent trees.

Studies with citrus species at the Beeville Substation indicated that the satsuma, grapefruit, kumquat, and a few varieties of oranges may be grown with success provided proper attention is paid to irrigation, orchard heating, and cultivation. In the tomato variety test at Troup, Matchless, Paragon, Earliana, Norton, and Beauty, in the order given, were the highest yielding varieties. In fertilizer tests with the tomato, acid phosphate at the rate of 500 lbs. per acre produced the highest yield, with 20 tons of manure second, and 500 lbs. of cottonseed meal third. Sulphate of potash, when used alone at the rate of 100 lbs. per acre, failed to increase the yield.

The production of cucumbers in greenhouses, J. H. BEATTIE (*U. S. Dept. Agr., Farmers' Bul. 1320 (1923), pp. II+30, figs. 18*).—This comprehensive discussion presents information of a general nature relating to greenhouse-grown cucumbers; location and growth of the industry; greenhouses suited to cucumber growing; relation of cucumbers to other forcing crops; companion crops; soils for greenhouse cucumbers; management of the soil; varieties and seed; management of the crop; enemies of greenhouse cucumbers; harvesting, grading, and packing; and yields and returns.

Preliminary studies on the sulphur content of the tomato, R. S. MARSH (*Amer. Soc. Hort. Sci. Proc., 19 (1922), pp. 83, 84*).—Analyses at the Missouri Station of the tip, region of blossoming, region of fruit, and base of young tomato plants treated with different fertilizers, indicated that the fertilizers caused considerable variation in the amount of sulphur and phosphorus present. In addition it was found that the amount of sulphur increased from the tip toward the base, it being evident that the older the tissue the higher the sulphur content. Analyses of the above-the-ground portion of greenhouse plants of different ages showed an increasing content of sulphur with advancing age. As reported earlier for the apple (E. S. R., 48, p. 635), wherever the sulphur content was high that of phosphorus was correspondingly low. This phenomenon is believed by the author to suggest that sulphur may liberate phosphorus from the older tissue for translocation to the younger tissue. A comparison of the results of analyses of plants from control and from acid phosphate plats showed a marked increase of the sulphur and phosphorus content in the fertilized plants. The greatest phosphorus content of the phosphated plants was found in the vicinity of the blossoms.

Solving the fruit growers' problems by plant breeding, E. F. PALMER (*Amer. Soc. Hort. Sci. Proc., 19 (1922), pp. 115–124*).—This is a comprehensive review of fruit-breeding projects under way at the Ontario Horticultural Experiment Station.

Crosses between the gooseberry and the black currant have resulted in two distinct types of plants, one closely resembling the black currant in all outward characters and the other very similar to the gooseberry in form, foliage, etc., practically lacking in thorns, but, unfortunately, sterile. Of 10,000 hybrid strawberries produced at the station in recent years, only one, a Pocomoke×Ozark seedling, is considered of real worth. Raspberry breeding, in which Marlboro, Herbert, and Cuthbert have been used as parents, has resulted in a large number of seedlings, one of which, Cuthbert×Marlboro, bears larger and firmer fruit than Cuthbert, but, unfortunately, is lower in quality and lighter in color. In general, Marlboro×Cuthbert crosses have been the most successful.

Peach-improvement studies have consisted in the growing of open-pollinated and known parent seedlings. With few exceptions, the open pollinated seedlings have markedly resembled the mother tree, suggesting to the author that peaches are, in general, self-pollinated under natural conditions. A much higher percentage of valuable peach seedlings was obtained in the controlled

crosses, and a succession of Elberta-like peaches has been selected which will greatly extend the Elberta season. Elberta×Arp has been a successful combination, resulting in a large proportion of valuable seedlings. Work with Elberta leads the author to suspect that this variety is a selfed seedling of Chinese Cling.

Approximately 21,000 seedling grapes, a large part of which are of known parentage, have been tested at the station in an effort to develop productive, self-fertile varieties of the Rogers type. The seedlings obtained by selfing were generally less vigorous than hybrids. Agawam, Campbell, and Brighton proved effective parents. Observations on color inheritance in grapes, presented in tabular form, conform in general with the data reported by the New York State Experiment Station (E. S. R., 34, p. 234).

Experiments in the storage of fruits, D. B. Adam (*Jour. Dept. Agr. Victoria, 21 (1923), No. 3, pp. 178–186*).—Studies conducted in the Government Cool Stores, Melbourne, indicated that 32° F. was a more satisfactory temperature for storing pears than were either 34 or 37°. The fruits at the two higher temperatures blackened shortly after removal from storage, preventing sale, and wrapping with paper had no apparent effect in preventing this blackening.

The stage of maturity at time of harvest proved to be an important factor. Kieffer pears harvested when slightly green kept much more satisfactorily than did more mature fruits. It is suggested that the blackening of pears in storage is the result of chemical changes which convert arbutin of the skin into hydroquinone and glucose and then into quinone and water. Of the several pear varieties tested, the Kieffer was by far the most susceptible to blackening.

The amount of pathological decay present on stored pears was found to be dependent upon the variety, cultural conditions under which grown, stage of maturity at harvest, and the care in handling. In comparing the effect of wrapping every layer, alternate layers, and no wrapping on Winter Nelis pears, it was evident that all fruits should be wrapped. In a test of the effect of three systems of air circulation on the percentage of moldy fruit, no one system was found superior. Winter Nelis pears from an irrigated orchard kept as well as fruit from a nonirrigated orchard. Brief notes are given upon the keeping qualities of several varieties.

Apple pollen germination studies, J. H. Beaumont and L. I. Knight (*Amer. Soc. Hort. Sci. Proc., 19 (1922), pp. 151–163*).—This is a report of studies, conducted at the Minnesota Experiment Station in the spring of 1922, to determine whether the pollen tube growth or the percentage of germination of a variety of pollen, when placed in an artificial medium to which a known variety of stigma was added, might be correlated with sterility data obtained in controlled crosses. A solution containing 5 per cent cane sugar and 1 per cent gelatin by weight was used as a growth medium.

Pollen tube growth was apparently stimulated by the presence of a stigma in the germination fluid, but since variations between varieties of stigmas were often no larger than differences obtained in duplicate tests with the same stigma, no general conclusions are drawn. Observations of the percentage of germination of various varieties of pollen showed that the presence of a stigma in the cultural medium induced higher germination than where no stigma was present, but no single variety of stigma was found superior to others in increasing germination. Marked variations were observed in the germinating capacities of 17 varieties of pollen tested, ranging from a minimum of 28.3 per cent for Gilbert Winesap to a maximum of 89.1 per cent for Gano.

Records taken on the length of growth during a 24-hour period showed Delicious to be the best of the 17 varieties in respect to length, producing a tube

length of 2.81 mm. as an average of 33 tests. The shortest tubes, 1.3 mm., were produced by Gilbert Winesap. Certain stigmas, such as McIntosh and Northwestern Greening, were noticeably more effective in stimulating length of tube than were such varieties as Hibernal and Patten. The data for the several tests are presented in tabular form.

Fertilization of a sour cherry orchard, J. L. KRAKER (*Michigan Sta. Quart. Bul., 5 (1923), No. 4, pp. 162–164*).—A demonstration in a Montmorency cherry orchard at Benzonia showed that nitrogen-bearing fertilizers are beneficial in promoting yield. Trees fertilized in the spring of 1922 with 3 lbs. of ammonium sulphate and 5 lbs. of acid phosphate yielded a net gain of $34.29 per acre above the control trees. Potassium apparently had a deleterious influence, in that trees fertilized with a complete mixture yielded little more than did the controls.

Twin and triplet peaches, C. H. CONNORS (*Jour. Heredity, 14 (1923), No. 2, pp. 89–92, figs. 3*).—In commenting upon the occurrence and cause of multiple fruit formation in the peach, the author explains that this abnormal condition may be due to either of two causes, (1) twin flowers and (2) an extra number of pistils, and in certain instances to a combination of these circumstances. Considerable variation was found in the tendency of varieties to form these abnormal fruits, they being most frequent in normal years in varieties belonging to the Crawford group. The frequency in any single season is apparently governed in part by environmental factors.

Citrus culture in Florida, H. J. WHEELER (*Jacksonville, Fla.: Amer. Agr. Chem. Co., 1923, pp. [7]+155, figs. 41*).—This is a well-illustrated handbook presenting general information relative to species, varieties, stocks, soils, planting, fertilization, cultivation, pruning, and control of various insect and fungus pests.

The chief diseases and pests of the orange and lemon groves of Spain, R. J. JANINI (*Internatl. Rev. Sci. and Pract. Agr. [Rome], n. ser., 1 (1923), No. 1, pp. 61–73, pls. 2*).—The more important pests are described and methods of control outlined.

Citrus industry in Japan, T. TANAKA (*Internatl. Rev. Sci. and Pract. Agr. [Rome], n. ser., 1 (1923), No. 1, pp. 25–36, pl. 1*).—A general article relating to citrus production in Japan and Taiwan, with particular attention to species, varieties, methods of culture, disease and insect pests, and marketing.

Preliminary report of walnut fertilizer trials, L. D. BATCHELOR and D. C. WYLIE (In *Addresses Delivered at the Fourth Annual Walnut Institute, 1922. Los Angeles and Orange County [Calif.] Farm Bureaus, Walnut Growers' Dept., pp. 14–18, figs. 4*).—Field tests, conducted cooperatively by the California Experiment Station and the California Walnut Growers' Association in two English walnut groves, have shown to date a net loss for fertilized trees ranging from $2.25 to $10.98 per tree in one orchard and from $3.92 to $13.13 in the other.

California garden flowers, shrubs, trees, and vines, E. J. WICKSON (*San Francisco: Pacific Rural Press, 1923, 2. ed., rev. and enl., pp. 255, pls. 15, figs. 14*).—This is a revised and extended edition of an earlier noted work (E. S. R., 33, p. 441).

The rose in America, J. H. MCFARLAND (*New York and London: Macmillan Co., 1923, pp. X+233, pls. 20, figs. 20*).—A popular treatise discussing the general development of rose growing in America and presenting information relative to species, varieties, culture, pruning, control of insects and disease, winter protection, etc.

How to grow roses, R. PYLE (*West Grove, Pa.: Conrad & Jones Co., 1923, 14. ed., rev. and enl., pp. 189, figs. 226*).—This revised and enlarged edition of a

previously noted work (E. S. R., 44, p. 45) shows several varieties of roses in colors.

Care of shade trees, compiled by H. V. S. Lord (*Altoona, Pa.: Author, 1922. pp. 77*).—This small handbook contains information relative to the requirements of shade trees, diseases and insects and methods for their control, and tree surgery.

Lists of plant types for landscape planting, S. F. Hamblin (*Cambridge: Harvard Univ. Press; London: Humphrey Milford, Oxford Univ. Press, 1923, pp. XI+63*).—This is a compilation of names of ornamental plants grouped according to their various uses in landscape work.

Garden construction, T. G. W. Henslow (*London: Odhams Press, Ltd., 1923, pp. XV+285, pls. 51*).—A comprehensive discussion of gardens, their construction, arrangement, plant materials, and uses.

FORESTRY.

An edaphic limit to forests in the prairie region of Illinois, G. D. Fuller (*Ecology, 4 (1923), No. 2, pp. 135–140, figs. 3*).—A forest survey of La Salle County, Ill., located in the Corn Belt area, indicated that the character of the soil is the limiting factor in controlling the distribution of tree growth. With the exception of a very narrow fringe of willows, etc., along the small streams, no indigenous trees were found upon the brown silt loam which characterizes the upland prairies. Furthermore, no indication was discovered that there ever had been any forest on this soil type. Wherever this grassland soil is uncovered by erosion there is a gradual tendency of the forest to encroach.

Second growth on cut-over lands in St. Louis County, T. S. Hansen (*Minnesota Sta. Bul. 203 (1923), pp. 6–50, figs. 40*).—Based on records of amount, kind, and age of timber on 103 0.1-acre sample plats located on nine distinct soil formations characteristic of the cut-over lands of the county, data are presented for each of the nine soil types and for the county as a whole.

Only 4 per cent of the cut-over area was found to be without reproduction, and this condition was evidently the result of repeated fires. For the greater part the stands were found to be comprised of younger age classes and are in many instances overstocked or understocked. The young stands are showing a satisfactory rate of growth, hardwoods averaging about 1 ft. and conifers about 8 in. in height a year. There are 1,090,046 acres of hardwood and 545,023 acres of mixed reproduction. Birch and poplar, constituting a large percentage of the reproduction, are characterized as prolific seeders and rapid growers, and in the author's opinion should be encouraged as sources of box, pulp, and specialty materials. It is pointed out that mills adapted to the utilization of such species should be established.

It is concluded that the utilization of cut-over lands in this county is not a difficult problem and resolves itself into protection of existing stands, their proper utilization, the planting of better species, and the reforestation of barren areas. Casual observation during the survey indicated that the areas upon which there had been no fire of any kind after logging were best adapted for conifer reproduction.

Sand blow planting, P. A. Herbert (*Michigan Sta. Quart. Bul., 5 (1923), No. 4, pp. 198, 199*).—Of various species planted in an effort to prevent drifting sand from filling an important drainage ditch, willows and poplars grown from cuttings planted 1 ft. apart in single or double rows were most effective.

Some of the original root collars are now buried 6 ft. in the sand. It is suggested that in order to permanently stop the the drifting sand it is necessary to plant poplars and willows at its source, following later with longer lived species such as spruce and pine.

The effect of soaking certain tree seeds in water at greenhouse temperatures on viability and the time required for germination, J. W. TOUMEY and W. D. DURLAND (*Jour. Forestry, 21 (1923), No. 4, pp. 369–375*).—Germination taken on 17 species of forest seeds submerged for different intervals, 3, 5, 10, 20, and 30 days, in jars of water held in a warm greenhouse indicated a marked correlation between the length of time that tree seeds submerged in water maintain their viability and the natural site conditions under which the species ordinarily grow. For example, the seed of swamp species such as bald cypress (*Taxodium distichum*) and sweet gum (*Liquidambar styraciflua*) appeared little affected by from 20 to 30 days' submergence in lukewarm, stagnant water. With most species extended submergence in water, that is for more than 5 to 10 days, greatly reduced the number of apparently viable seeds and in the case of honey locust (*Gleditsia triacanthos*) seeds soaked for more than 5 days failed to germinate. This is explained by the fact that only a relatively short time is required for most leguminous seeds to swell when placed in warm water. Gleditsia seeds planted without preliminary soaking required nearly 30 days to start germination. The data upon which the discussion is based are presented in detailed tabular form.

The restoration of chestnut woods, L. MANGIN (*Internatl. Rev. Sci. and Pract. Agr. [Rome], n. ser., 1 (1923), No. 1, pp. 37–42*).—The depletion of chestnut trees in various Departments of France is attributed to the extensive use of the wood in tanneries and to the depredations of an unknown pest known as the ink disease. It is suggested that certain varieties of chestnut from eastern Asia known to be resistant to bark diseases and other troubles could be introduced to the ultimate advantage of the industry.

Acacias, E. H. WILSON (*Mass. Hort. Soc. Bul. 11 (1923), pp. 57–61*).—The distribution and habits of growth of the genus Acacia in Australia are discussed. One species, *A. melanoxylon*, attains a height of 100 ft., but in general they comprise small trees forming understory growth in Eucalyptus forests. For wood *A. melanoxylon* is the most valuable species. For general usefulness and beauty *A. pycnantha* is very desirable, on account of its tanning bark and golden flowers; and *A. baileyana* is described as a beautiful species. Notes are given on the introduction of various species into Europe and the United States.

Bibliography of the woods of the world (exclusive of the temperate region of North America) with emphasis on tropical woods, S. J. RECORD (*New Haven, Conn.: Author, 1923, 2. ed., rev. and enl., pp. 40*).—A revised and enlarged edition of the previously noted paper (E. S. R., 46, p. 737).

The woods of the forest of Analamazaotra, Madagascar, H. LECOMTE (*Madagascar: Les Bois de la Forêt d'Analamazaotra. Paris: Augustin Challamel, 1922, pp. VII+189, pls. 56, figs. 2*).—This is an exhaustive treatise on the wood of a large number of species occurring in the forest of Analamazaotra, Madagascar. Attention is paid to the anatomical characters of the wood, and microphotographs are shown of the transversal and longitudinal sections. General Notes on the Forests of Madagascar are presented by A. Fauchère (pp. 161–181).

Forest conditions in Australia with special reference to Victoria, H. D. TIEMANN (*Jour. Forestry, 21 (1923), No. 4, pp. 349–368, fig. 1*).—This paper

discusses the distribution of forest areas in Australia and points out their dependency on adequate rainfall. Fire losses are even more severe in Australia than in the United States on account of the land-clearing operations of settlers and the almost total lack of the conservation spirit. The more important species found in the forests of Victoria and Tasmania are discussed in relation to their economic value, size of tree, and general characteristics. Certain exotic species, for example, the Monterey pine (*Pinus radiata*), have exhibited an unusual capacity for very rapid growth.

[Report of the] division of forestry, J. BAIRD and M. SCHAAF (*Mich. State Dept. Conserv. Bien. Rpt., 1 (1921–22), pp. 189–213, figs. 12*).—This report discusses various activities, including fire control, nursery operations, reforestation work, and general administrative duties.

Report of the division of forestry (*Mass. Commr. Conserv. and State Forester Ann. Rpt., 1922, pp. 25–49*).—As in previous years (E. S. R., 47, p. 240), the activities of the division of forestry were devoted to the management of the State forests and nurseries, rendering assistance to private owners, reforestation, suppression of fires, and the combating of injurious insect and fungus pests.

Annual progress reports on forest administration in the Presidency of Bengal for the years 1920–21 and 1921–22, R. C. MILWARD (*Bengal Forest Admin. Ann. Rpts., 1920–21, pp. II+44+3; 1921–22, pp. [3]+46+3*).—These are the usual reports (E. S. R., 45, p. 646) relating to administrative activities and general silvicultural operations.

DISEASES OF PLANTS.

Report of the botanist, A. K. PEITERSEN (*Colorado Sta. Rpt. 1922, pp. 14, 15*).—Among various items reported upon the author states that he has been unable to inoculate sunflower plants with the supposed organism isolated from diseased plants of the previous year.

Studies are reported of about 150 varieties of beans to test their susceptibility to bean rust, and marked differences were noted among the varieties.

Data obtained from laboratory tests and field trials with hard seed in alfalfa are believed to indicate that hard seeds are the result of environmental factors and are not due to hereditary characters.

Report of the department of botany, D. C. NEAL (*Mississippi Sta. Rpt. 1922, pp. 25–28*).—In studies for the control of tomato diseases, selections of tomatoes made in 1921 were again propagated in wilt-infected seed beds and planted in progeny rows on wilt-infected land. The results indicate considerable resistance to wilt on the part of some varieties. A correlation was found to exist in the amount of wilt developing in the seed bed and that present in the field after an interval of about 36 days.

Notes are given of studies of resistance and susceptibility of some of the leading varieties of sweet potatoes to black rot due to *Sphaeronema fimbriatum* and on the occurrence of surface rot of sweet potatoes due to *Fusarium oxysporum*.

A brief account is given of experiments carried on for the control of pecan scab, supplementing work previously described (E. S. R., 47, p. 250).

An investigation on corn root rot due to *F. moniliforme* is briefly reported upon in which an attempt was made to determine the correlation between sand-box germination tests and field performance of corn suspected of infection. It is claimed that the sand-box test does not give an adequate index to resistance in corn.

Noteworthy facts on plant diseases for season 1921, L. F. STRICKLAND (*N. Y. State Hort. Soc. Proc., 67 (1922), pp. 126–139*).—Attention is called to certain facts which became apparent from the year's records in connection with fruit diseases in New York, which as here reviewed include peach leaf curl and brown rot; apple scab, fruit spots, and rust; pear, quince, and apple fire blight; cherry yellow leaf; and quince brown rot. Some reports by counties are included regarding diseases of fruits for 1921.

The prevention of plant diseases, L. R. JONES (*N. Y. State Hort. Soc. Proc., 67 (1922), pp. 275–281*).—Results of experimentation during a term of years are summed up in advice regarding orchard sanitation, clean seeds and stocks, and disease resistant strains.

Division of plant pathology and physiology (*Texas Sta. Rpt. 1921, pp. 17–19*).—In a study of watermelon diseases a fungus was determined as the cause of blossom-end rot of watermelons, and no essential difference could be found between this fungus and *Diplodia tubericola* which causes Java black rot of the sweet potato. Cross inoculation experiments indicated that strains of the fungus taken from the sweet potato and watermelon were identical. Cross inoculations with the anthracnose fungus of watermelons showed conclusively that this fungus (*Colletotrichum lagenarium*) will readily infect cucumbers, cantaloups, squashes, gourds, and citrons.

Investigations of the root rot fungus (*Ozonium omnivorum*) are said to have shown that it readily lives over winter on susceptible roots which may remain alive in the soil.

A study of rotted stored potatoes showed the presence of a Fusarium that is considered quite similar to *F. oxysporum*, the cause of the wilt of Irish potatoes in the field, although some distinct differences are noted, and further studies will be necessary to determine the identity of the organisms.

In studies of tomato diseases the causal organism of wilt (*F. lycopersici*) was found in every part of the plant, having been isolated from the roots, stems, petioles, leaves, calyx, and the fruit itself. It has not yet been determined whether the seed carry the disease. A Fusarium wilt (*F. conglutinans*) is reported to cause a serious disease of cabbage in the Rio Grande Valley, and downy mildew (*Peronospora effusa*) was identified as the chief cause of the disease of spinach. An apparently new and undescribed disease, probably of bacterial origin, was observed on lettuce.

Plant diseases of 1920–21 [Canada], B. T. DICKSON (*Quebec Soc. Protect. Plants, Ann. Rpt., 13 (1920–21), pp. 66, 67*).—In giving this brief account of the commonest diseases of the year, the author has dealt with them on a crop basis where possible as found in orchard, field, and garden.

The immunization of plants, G. P. MCROSTIE (*Quebec Soc. Protect. Plants, Ann. Rpt., 13 (1920–21), pp. 73–78, figs. 4*).—The plans here set forth have been noted as presented in a contribution from another source (E. S. R., 47, p. 750).

Spraying v. dusting, C. E. PETCH (*Quebec Soc. Protect. Plants, Ann. Rpt., 13 (1920–21), pp. 68–72*).—In the preparation of this paper the author followed closely the article contributed by Sanders and Kelsall (E. S. R., 46, p. 845), enlarging or criticizing where necessary to permit application to Quebec conditions.

Evidence of the seed carriage of the Euphorbia rusts, Uromyces pro eminens and U. dictosperma, E. B. MAINS (*Ind. Acad. Sci. Proc., 1921, pp. 137–139*).—Though the evidence here outlined is considered as proving that *U. proeminens* and *U. dictosperma* are carried on seed of *E. dentata* and *E. arkansana*, respectively, it has not yet been shown just how this takes place.

Observations concerning Puccinia pattersoniana and P. moreniana, E. B. MAINS (*Ind. Acad. Sci. Proc., 1921, pp. 133–135, fig. 1*).—Evidence briefly noted

suggests strongly that *P. pattersoniana* has its aecial stage (perhaps *P. moreniana*) on Brodiaea.

Saprophytic and parasitic fungi found on sprouting seed, L. C. Doyer (*Meded. Nederland. Mycol. Ver., No. 11 (1921), pp. 60–65*).—A brief account is given of attempts since 1919 to secure cereal seed free from disease.

Foot rot disease of wheat (*Kansas Sta. Bien. Rpt. 1921–22, pp. 16, 17*).—Foot rot of wheat is said to have been observed in five counties of the State. Several fungi have been found associated with the disease, among them *Helminthosporium* sp. Hendersonia (*Wojnowicia graminis*), and a fungus that may prove to be *Ophiobolus caricti*. If additional studies of the latter fungus should confirm the supposition, it will establish the occurrence of take-all of wheat in Kansas.

Soil infestation is considered the principal means of carrying over the fungi, especially where wheat stubble is plowed under.

The foot rot disease is said to have behaved differently in the seasons under observation. In 1922 diseased plants attained the heading stage but did not mature normal grain; while in 1921 the plants seldom formed heads. Studies are in progress of certain grasses on the supposition that they may be concerned in the spread of the disease.

Celery blight or leaf spot, G. H. Coons (*Michigan Sta. Quart. Bul., 5 (1923), No. 4, pp. 190–193, figs. 2*).—Celery leaf blight, due to *Septoria apii*, is said to cause in some seasons severe losses in Michigan. The author claims that it may be controlled by using clean ground for the seed beds, by treating the seed with a solution of corrosive sublimate or sowing 2-year-old seed, and by thoroughly spraying the plants in the seed bed and field with homemade Bordeaux mixture.

Armillaria mellea as a potato disease, M. Wilson (*Roy. Scot. Arbor. Soc. Trans., 35 (1921), pt. 2, pp. 186, 187*).—*A. mellea*, remarkable for the number and variety of coniferous and deciduous trees it attacks, has now been recorded as occurring on potato in Japan and Australia. The results of attack are described. The disease was traced back to an old sycamore stump attacked by *A. mellea*.

Mosaic and potato yields in Michigan, J. E. Kotila (*Michigan Sta. Quart. Bul., 5 (1923), No. 4, pp. 188, 189, fig. 1*).—The author has attempted to evaluate the crop losses due to a mild attack of potato mosaic. In a field that was estimated to show 25 per cent of mosaic, 100 hills of mosaic and an equal number of healthy hills were marked during the growing season and dug October 14, 1922. Care was exercised to select mosaic hills that at the time showed the same number of stems and the same vigor of growth as the healthy hills. At harvest the yield from the diseased hills was less than that from the healthy ones by a calculated yield of 35 bu. per acre.

Leaf curl and mosaic disease of potatoes and their relation to deterioration in yield, T. Whitehead (*Univ. Col. No. Wales, Bangor, Dept. Agr., Rpts. Expts., 1920–21, pp. 48–50*).—Experimentation on leaf curl only is here described, such work being designed to ascertain eventually the actual loss in yield due to this disease. The plats planted with affected seed gave not more than half the weight of crop obtained from healthy seed tubers.

The varietal and species hosts of Synchytrium endobioticum, F. Weiss and C. R. Orton (*U. S. Dept. Agr. Bul. 1156 (1923), pp. 1–16, pls. 4, fig. 1*).—An account is given of experiments carried on cooperatively between the U. S. Department of Agriculture, the Pennsylvania Experiment Station, and the Pennsylvania Department of Agriculture, in which about 30 American varieties and a considerable number of imported varieties of potatoes were found immune to attack by the potato wart fungus. The tomato plant is also known to be subject

to attack by this fungus. Tests were made of a considerable number of varieties, none of which proved immune to the disease.

A large number of other solanaceous plants, including a number of weeds of Pennsylvania, and the eggplant, tobacco, petunia, and pepper were all tested for susceptibility to the wart organism, but infection was not observed.

The adaptability and use of wart-immune varieties of the potato in the quarantined areas of Pennsylvania, R. E. HARTMAN (*U. S. Dept. Agr. Bul. 1156 (1923), pp. 17–19, figs. 2*).—As a result of studies of potatoes in continuation of the above work, a number of varieties were found immune to wart disease, and it is suggested that in the zone surrounding the infested area in Pennsylvania only such varieties as Irish Cobbler and Green Mountain be permitted to be grown.

The stability of wart immunity, F. WEISS (*U. S. Dept. Agr. Bul. 1156 (1923), pp. 20, 21*).—Continuing the above work, a brief account is given of tests of a number of varieties of potatoes that are known to be immune to wart, in which tubers affected by leaf roll, mosaic, curly dwarf, etc., were planted. The results show that not in a single instance was there any deterioration in the degree of immunity.

The nature of the organism found in the Fiji galls of sugar cane, F. P. MCWHORTER (*Philippine Agr., 11 (1922), No. 4, pp. 103–111, pls. 2, figs. 2; also in La. Planter, 70 (1923), No. 8, pp. 148–150, figs. 2*).—Giving a short bibliography of the subject and an account of his own studies, the author states that he has found the plasmodial bodies present in the cells of Fiji disease galls to be those of an amoeba showing many characters of Entamoeba. The name here proposed is *Phytamoeba sacchari*. The organism can be cultured in cane juice. It was hoped that its ability to grow in the juices of different cane varieties could be used as a test for the susceptibility of the varieties to Fiji disease, but the organism proved so difficult to culture that this method of testing proved impracticable.

Eradication of Fiji [disease] at Calamba, G. H. PRITCHETT (*Sugar Cent. and Planters News, 2 (1921), No. 10, pp. 413–416, figs. 3*).—The success of methods pursued on the Calamba Sugar Estate is said to indicate the early practical extirpation from cane fields of the Fiji disease, which has been present since 1918 and is spreading, particularly in foreign varieties, as Yellow Caledonia.

The inception in 1920 of a vigorous campaign of eradication was followed by the establishment of experimental plats to study the disease, the present article noting some of the more significant experiments and results.

It early became apparent that no crop could be taken from canes having Fiji disease, which was communicated by contact with diseased plants, probably through the root system, but probably not carried in the soil.

Cane diseases in Negros, H. A. LEE and E. W. KOPKE (*Sugar Cent. and Planters News, 2 (1921), No. 12, pp. 568, 569*).—A survey including all but one or two of the cane-growing districts of Occidental Negros showed only a moderate loss due to Fiji disease at several points visited, the disease apparently not having prevailed long at those places. The most satisfactory means of minimizing losses from Fiji disease appears to be the use of resistant varieties, some of which are indicated, as Badilla, H 109, and some native canes.

Mosaic disease was more or less in evidence at Silay, Talisay, Bacolod, Maao, and throughout the La Carlota, Isabela, and Binalbagan regions, but not at Victorias, Manapla, or Cadiz. The disease is transmitted by cutting and may be minimized by careful selection. It is stated that D 1135 has been found somewhat resistant to mosaic.

Ring spot is fairly common though not destructive in the foothills of Negros. D 1135 is somewhat resistant.

A disease resembling the sereh of Java occurred sparingly. It is called the Olaa disease from its resemblance to a disease appearing at Olaa in Hawaii, but afterwards proving to be distinct from sereh as known in Java.

Resistance of swedes to finger-and-toe or clubroot disease, T. WHITEHEAD (*Univ. Col. No. Wales, Bangor, Dept. Agr., Rpts. Expts., 1920–21, pp. 40–47*).—High resistance to clubroot disease was shown by Danish swede varieties 4 and 25, which also possess other desirable qualities as indicated by comparisons in tabular form.

Fruit diseases of the [1920] season, H. H. WHETZEL (*N. Y. State Hort. Soc. Proc., 66 (1921), pp. 37–48*).—This review, with discussion, of the fruit disease situation during 1920 deals with apple scab, fire blight, peach leaf curl and brown rot, cherry leaf spot, and apple root rot, also with dusts, sprays, and schedules.

The parasitic diseases of tree fruits in Washington, F. D. HEALD and B. F. DANA (*Wash. State Hort. Assoc. Proc., 17 (1921), pp. 145–155*).—Condensed information relates to the prevalence of parasitic diseases of tree fruits (apple, apricot, cherry, peach, pear, plum, and prune) during 1915–1920, and control measures for some of the more serious diseases.

Apple blotch (*Oklahoma Sta. Rpt. 1922, pp. 21, 22*).—A summary account is given of five years' work carried on for the control of apple blotch, in which Bordeaux mixture was found to be the only efficient method of control. Four applications of Bordeaux mixture and one of commercial lime sulphur are recommended, lead arsenate being added for the control of insect pests.

Lessons from the 1921 mildew epidemic, D. F. FISHER (*Wash. State Hort. Assoc. Proc., 17 (1921), pp. 162–171*).—Preliminary investigations showed the cause of the sudden and severe 1921 epidemnic of mildew on pears to be caused by the same organism as that causing apple powdery mildew. It was soon found that pears are more susceptible than apples to sulphur injury, though wettable sulphur could be used on pears when lime-sulphur solution (1–50) could not. Lime sulphur can probably be safely used in the pink and calyx sprays on pears as on apples, but for the next spray some other material should be used. Wettable sulphur (as fine as possible) 8 lbs., glue 0.25 lb., and water 50 gal., make up what is considered a good third spray.

Bacterial disease of the Wragg cherry, W. G. SACKETT (*Colorado Sta. Rpt. 1922, p. 12*).—This disease, previously described by the author (E. S. R., 38, p. 551), is said to have appeared in a mild form in the Arkansas Valley in Colorado. The organism previously described was isolated from leaves and fruit, but successful inoculations with it were not obtained. It is thought that successful artificial inoculation depends upon the introduction of the causal organism at a particular stage in the development of the fruit and leaves, and that this occurs within very narrow limits.

Fungi on Phalaris bulbosa, V. ZEMAN (*Rev. Facult. Agron. La Plata, 3. ser., 14 (1921), No. 3, pp. 179–184*).—Fungi found as parasites or saprophytes on *P. bulbosa* during 1919–20 are here listed, with technical descriptions, to include as species formerly known *Gibberella saubinetii, Pleospora herbarum, Stagonospora graminella, Dinemasporium graminum, Conisporium arundinis, Periconia pycnospora,* and *Haplographium chlorocephalum,* and as new species *Physalospora phalaridis, Lizoniella platensis, Leptosphaerella platensis, Diplodinula phalaridis, S. infossa, Couturea phalaridis, Steganosporium argentinense,* and *Torula (Trachytora) asperrima.*

Japanese larch (Larix leptolepis) and the new disease, G. LEVEN (*Roy. Scot. Arbor. Soc. Trans., 35 (1921), pt. 2, pp. 118–121*).—Dissimilarity among

individual larches (*L. leptolepis*) is noted, and the possibility is suggested of isolating a type resistant to the recently recorded disease of Japanese larch ascribed to a Phomopsis.

The occurrence of the Phomopsis disease of the Japanese larch in Yorkshire, M. WILSON (*Roy. Scot. Arbor. Soc. Trans., 36 (1922), pt. 1, pp. 115, 116*).—An opportunity for comparing the diseased larch trees referred to in the article above noted with specimens of the Japanese larch known to be attacked by *P. pseudotsugae* left little doubt that the fungus is the same in the two cases, the hyphae, the wounds produced, and the healing process being almost identical.

The oak mildew, M. WILSON (*Roy. Scot. Arbor. Soc. Trans., 36 (1922), pt. 1, pp. 92–97*).—To an account of oak mildew, referring freely to accounts by Neger (E. S. R., 33, p. 745) or by others, regarding the agency in this connection of one or more varieties of *Microsphaera alni* (*M. alni quercina* or *M. alni extensa?*), are added notes by Munro regarding cooperation between insects and fungi in certain kinds of damage to forest trees.

White pine blister rust in Michigan, D. V. BAXTER and G. H. COONS (*Michigan Sta. Quart. Bul., 5 (1923), No. 4, pp. 193–196, fig. 1*).—White pine blister rust was reported as present in 1922 on white pines and various species of Ribes in two counties of Michigan.

To prevent further spread of the blister rust, the authors suggest that white pine and currants and gooseberries should not be shipped from nurseries where blister rust is known to be present. All infected plants should be burned at once. In districts where blister rust occurs commercial plantings of currants and gooseberries are likely to suffer great damage from white pines, and such trees should be destroyed. With ornamental plantings of white pine, currants and gooseberries should be destroyed in a zone of at least 200 yds. about white pine plantings.

Brown bast disease of plantation rubber, its cause and prevention, R. D. RANDS (*Dept. Landb., Nijv. en Handel [Dutch East Indies], Meded. Inst. Plantenziekten, No. 47 (1921), pp. 57, pls. 5, figs. 2; also in Arch. Rubbercult. Nederland. Indië, 5 (1921), No. 5, pp. 223–278, pls. 5, figs. 2*).—This main account in English with summary in Dutch relates to studies by the author carried out since 1918, looking to the ascertainment of the nature, cause, and prevention of Hevea brown bast.

Histological studies on the brown bast disease of plantation rubber, R. D. RANDS (*Dept. Landb., Nijv. en Handel [Dutch East Indies], Meded. Inst. Plantenziekten, No. 49 (1921), pp. 28, pls. 9*).—Studies by the author during the previous two years (see above) show that Hevea brown bast is nonparasitic and is due to certain tapping methods; that it can be produced experimentally in a large percentage of trials by severely overtapping healthy trees; and that by taking advantage of the existing great differences in susceptibility, types not subject to this form of deterioration can be selected out. The more or less specialized histological and microchemical features involved in this study are here given in a separate (English) paper, with a bibliography.

These studies, as systematically detailed, deal with the material and technique, the normal and pathological anatomy of Hevea, gum secretion, origin and physical properties of the gum, burr formation, wound reaction and related literature, studies on local wound reaction and its relation to brown bast, the nature of brown bast, and microchemical tests for the presence of the disease.

Brown bast is a nonparasitic disease of tapped trees characterized by discoloration and dryness of an area of bark extending below the tapping cut.

Affected bark is not killed, but is often more active than normal, as shown by the overgrowths or burrs which frequently develop. The discoloration and cessation of latex flow are caused by the deposition of a yellowish gumlike substance in the tissues, impregnating many cell membranes, filling the intercellular spaces, and clogging the latex vessels. The gum is apparently secreted into these elements by the adjacent living cells and does not arise by the breaking down of cell walls. In addition to gum secretion, the latex itself is usually found coagulated in the vessels affected. The death of the vessel protoplast may cause the formation of an inclosing cambium and a woody burr in the bark.

A striking similarity was observed between brown bast and the local discoloration which occurs at the border of ordinary wounds in Hevea.

Brown bast appears to represent an extended or accentuated type of wound-gum secretion, probably resulting from the response on the part of the tree to overfrequent tapping.

Stained sections and microchemical tests show that the yellowish secretion can not be classed with the true gums and probably not with materials found in woody or lignified membranes. In strong potassium or sodium-hydroxid solution the fresh gum turns a dark-orange color, while the normal stone cells and wood become light greenish. Aside from this striking exception, it reacts positively toward most lignin reagents. From its physical characteristics, manner of formation, and probable function, however, the yellowish secretion agrees more nearly with the substance, or class of substances, known in the literature as wound gum.

Soil conditions affecting the prevalence of Fomes annosus [Trametes radiciperda], M. L. Anderson (*Roy. Scot. Arbor. Soc. Trans., 35 (1921), pt. 2, pp. 112–117*).—Observations are offered regarding the presence, prevalence, saprophytism, parasitism, and other associations of *F. annosus* in forests, especially where it finds conditions not very favorable to the forest growth. Acidity in the soil, possibly due to several causes, is suggested as a factor favoring the fungus.

Careful selection of species for planting is regarded as the most obvious way of dealing with the cause of this rot. In case of slight attack, a thinning of the weakest trees is suggested, as is also, if necessary, a short rotation of hardwood.

The bluing of coniferous timber, M. Wilson (*Roy. Scot. Arbor. Soc. Trans., 36 (1922), pt. 1, pp. 82–92*).—From results of studies noted, it is concluded that timber blued by the presence of *Ceratostomella pilifera* is slightly weaker than healthy timber.

The toxicity of zinc chlorid to wood destroying fungi, C. R. Patrie (*Idaho Forester, 1921, pp. 31–33*).—In the experimental work here reported Douglas fir (*Pseudotsuga taxifolia*), white fir (*Abies grandis*), and chestnut (*Castanea dentata*) were used as the culture media, these being chosen as typical of the more extensively used conifers and hardwoods and as giving results presumably having a direct practical application. The methods are briefly outlined, and the results as tabulated tend to indicate that the species of wood has little effect on the toxicity of zinc chlorid to wood destroying fungi. Zinc chlorid when impregnated in Douglas fir, white fir, and chestnut wood is found to be toxic to the growth of *Lenzites sepiaria* at the concentration of 0.333 per cent based on the wet weight of wood, this result differing considerably from the results previously obtained by others. From the results here reported it appears that when the concentration of zinc chlorid in wood treated with this chemical is reduced through leaching below this percentage, the wood will be left susceptible to decay.

ECONOMIC ZOOLOGY—ENTOMOLOGY.

Mammals of the District of Columbia, V. BAILEY (*Biol. Soc. Wash. Proc., 36 (1923), pp. 103–138*).—In this paper the author lists 9 species additional to the 38 species recorded in the paper published in 1896 (E. S. R., 8, p. 473).

Economic entomology, C. FERRIÈRE (*Éntomologie Economique. Bern: Ernest Bircher, 1922, pp. 36*).—This pamphlet discusses the modern methods of insect control and their application in Switzerland.

The host selection principle as advanced by Walsh, F. C. CRAIGHEAD (*Canad. Ent., 55 (1923), No. 4, pp. 76–79*).—This account is supplemental to that of the author previously noted (E. S. R., 46, p. 353).

Report of the entomologist, D. T. FULLAWAY (*Hawaii Bd. Commrs. Agr. and Forestry [Bien.] Rpt., 1921–22, pp. 53–68, pls. 2, fig. 1*).—This report for the biennial period ended December 31, 1922, discusses fig and pineapple insect investigations, and horn-fly, mealybug, and army worm control.

Thirteenth annual report of the State entomologist of South Dakota for the period ending June 30, 1922, H. C. SEVERIN (*S. Dak. State Ent. Ann. Rpt., 13 (1922), pp. 67, figs. 26*).—This report includes an account of the more important insects attacking the apple in South Dakota (pp. 17–60).

Chemical, physical, and insecticidal properties of arsenicals, F. C. COOK and N. E. MCINDOO (*U. S. Dept. Agr. Bul. 1147 (1923), pp. 58*).—This is a report of studies undertaken in order to gain a better understanding of the properties of arsenicals with a view to improving them and to producing new arsenicals for insecticidal purposes. The results of the studies, which were conducted cooperatively by the Bureaus of Chemistry and Entomology, are summarized as follows:

"Arsenious oxid, commercially known as white arsenic, or simply as arsenic, is the basis for the manufacture of all arsenicals. Samples of commercial arsenious oxid vary in purity, fineness, apparent density, and in the rate of solution in water (soluble arsenic), which accounts for the diverse chemical and insecticidal results reported in the literature. Arsenites are prepared by combining arsenious oxid with a base. Arsenates are produced by first oxidizing arsenious oxid to arsenic oxid (arsenic acid) and then combining the material with a base. Except for their water content of approximately 50 per cent, the paste arsenicals have the same general composition as the powdered arsenicals.

"The usual lead arsenate on the market, acid lead arsenate ($PbHAsO_4$), is well standardized and stable. Basic lead arsenate ($Pb_4PbOH(AsO_4)_3$), also well standardized and stable, is being manufactured at present only to a limited extent. Chiefly because of its low arsenic and high lead contents, basic lead arsenate is more stable and therefore less likely to burn foliage than acid lead arsenate. It possesses weaker insecticidal properties and is somewhat more stable in mixtures than acid lead arsenate.

"Commercial calcium arsenate (arsenate of lime), the manufacture of which is rapidly becoming standardized, contains more lime than is required to produce the tribasic form. Paris green, an old and well-standardized arsenical, is less stable and contains more 'soluble arsenic' than commercial arsenates of lead or lime. Laboratory samples of aluminum arsenate, barium arsenate, and a copper barium arsenate mixture, in the powdered form, were tested. The last named gave excellent insecticidal results.

"The following combinations of insecticides and fungicides were found to be chemically compatible: Lime sulphur and calcium arsenate, nicotin sulphate and lead arsenate, and Bordeaux mixture with calcium arsenate, acid lead arsenate, zinc arsenite, or Paris green. The following combinations were found

to be chemically incompatible: Soap solution with either calcium arsenate or acid lead arsenate, kerosene emulsion with either calcium arsenate or acid lead arsenate, and lime sulphur with acid lead arsenate. Combined with nicotin sulphate, calcium arsenate always produces free nicotin, and unless a decided excess of free lime is present soluble arsenic is produced. The combination of sodium arsenate with Bordeaux mixture as used in the experiments here reported gave no soluble arsenic.

"Of all the arsenicals tested, acid lead arsenate and zinc arsenite were the most adhesive and Paris green the least adhesive on potato foliage. The use of lime with arsenicals applied to potato foliage did not increase their adhesiveness. The suspension properties of the powdered arsenicals are of value in differentiating 'light' from 'heavy' powders, as determined by their apparent densities. The physical properties of the commercial powdered arsenicals could not be satisfactorily determined by sieving, as they are generally amorphous and pack in the sieve on shaking. Arsenious oxid samples sometimes contain or consist of relatively coarse crystals, so that sieving may provide valuable data. Microscopic examination gave little information concerning the desirable physical properties of the amorphous or seemingly amorphous powdered arsenicals. Differences in size of crystals present in the arsenious oxid samples were detected under the microscope.

"The toxicity findings are based on the use of equivalent quantities of arsenious and arsenic oxids. Higher percentages of toxicity were found for acid lead arsenate than for basic lead arsenate. The different samples of calcium arsenate tested varied widely in toxicity. When lime or Bordeaux mixture was added to arsenicals, the toxicities were reduced. The average toxicity of the three samples of Paris green and that of one zinc arsenite tested was slightly more than that of an acid lead arsenate and a sodium arsenate. Of the four samples of arsenites, the Paris green samples gave the highest values, zinc arsenite being much less toxic. Based on equivalent metallic arsenic percentages, the Paris green samples gave values no higher than that of the acid lead arsenate tested. Several new arsenates tested did not show as high toxicities as did acid lead arsenate. Of the various bases tested, lead oxid showed some insecticidal value, while the oxids of zinc, magnesium, and copper showed little and lime no value. Arsenic acid lead arsenate, and one sample of calcium arsenate gave high and practically equal toxicities. Arsenious oxid (white arsenic) gave lower and variable results. The percentages of water-soluble arsenic in the original arsenicals had little or no influence on the locality except in the case of those arsenicals which were entirely or largely water soluble. These had high percentages of toxicity.

"The determination of reaction in terms of the pH value of water extracts from the bodies of various insects fed all of the different arsenicals and also from the bodies of control insects showed uniformly a slight acidity. These results indicate that the arsenic compounds fed did not affect the pH values as determined on dead insects. The minimum dosage of metallic arsenic required to kill a honeybee is approximately 0.0005 mg., while 0.0273 mg. (or 54 times as much) is required to kill a full-grown silkworm. Honeybees, confined in cases, void none of the arsenic eaten, whereas silkworms void 90 per cent of the amount ingested. Thus, in reality, about 6 times, rather than 54 times, as much arsenic is fatal to a silkworm as is required to kill a honeybee under the somewhat unnatural living conditions.

"The conclusions that may be drawn from this investigation are that a chemical analysis of an arsenical does not give sufficient data to judge satisfactorily its insecticidal properties, and a toxicity study alone does not show

that an arsenical is suitable for general insecticidal purposes, but both a chemical analysis and a thorough toxicity study are required in order to judge whether or not an arsenical is a satisfactory insecticide."

A list is given of 53 references to the literature cited.

Entomology [at the Oklahoma Station] (*Oklahoma Sta. Rpt. 1922, pp. 18–20*).—Eight methods of control for the peach borer were tested, each being of some value, but, with the exception of Sulphocide applied in 50 per cent dilution and concentrated form, only one gave absolute immunity. The application of a coating of Borowax 2 or 3 in. in width about the trunk of the tree just below the fork to hold ordinary newspaper, which was wrapped about the trunk of the tree, and extended therefrom to the base, prevented infestation. The use of paradichlorobenzene is described. Several natural enemies were found attacking the borer in the larval stage, one of which occurred in sufficient numbers to warrant rearing it, as high as 72 per cent of the borers having been found parasitized during the latter part of August.

It is believed that under certain conditions the green bug can be checked almost completely by the application of nicotin dust, good results having been obtained when a 10 per cent dust consisting of Blackleaf 40 and hydrated lime was used. Field tests have demonstrated that from 90 to 95 per cent of green bugs can be killed even where the infestation is heavy.

In a competitive egg-laying test with different varieties of bees the three-banded Italian was awarded first place.

Is poliomyelitis an insect-borne disease? C. T. Brues (*Sci. Mo., 16 (1923), No. 5, pp. 471–487, figs. 12*).—This is a paper presented at the annual meeting of the American Association for the Advancement of Science, at Boston, on December 29, 1922.

Notes on termites attacking tea in Ceylon, J. C. Hutson (*Trop. Agr. [Ceylon], 60 (1923), No. 2, pp. 83–87*).—This is a brief account of termites which are a source of injury to the tea bush in Ceylon.

Grasshopper control, C. P. Gillette (*Colorado Sta. Rpt. 1922, p. 18*).—Work by C. L. Corkins with crude arsenic as an active poison in the arsenic bran mash is said to have given good results, even in the control of the Mormon cricket (*Anabrus simplex*).

Improved methods of controlling grasshoppers, R. A. Cooley, J. R. Parker, and A. L. Strand (*Montana Sta. Circ. 112 (1923), pp. 20, fig. 1*).—This is a summary of information on grasshopper control.

Two years of combating locust in Tomsk Government, R. P. Berezhkov (*Trudy 2. Vseross. Ent. Fitopat. Sezda, Petrograd, 1920, pp. 38–42*).—Grasshoppers of the species *Gomphocerus sibiricus* L. and *Stenobothrus morio* L. are the source of the greatest insect injury in Tomsk Government. In 1902 they destroyed up to 100,000 acres of crops in Kainsk County alone, and in 1918 more than 350,000 acres were destroyed in the Tomsk Government.

Arsenite of soda as a locust poison, C. W. Mally (*Union So. Africa Dept. Agr. Jour., 6 (1923), No. 3, pp. 220–232, figs. 6*).—This is an extended discussion of the subject, in which the author concludes that since treacle-arsenite, liquid arsenite, and powdered arsenite of soda serve the same purpose, the one which proves to be the cheapest in practice should be used.

Chinch-bug barriers, W. P. Flint (*Illinois Sta. Circ. 270 (1923), pp. 8, figs. 4*).—This practical summary of information is a revision of a circular issued in 1919 (E. S. R., 44, p. 451).

A froghopper damaging cacao in Panama, C. B. Williams (*Bul. Ent. Research, 13 (1923), No. 3, pp. 271–274, pl. 1, figs. 3*).—Under the name *Clastoptera theobromae* the author describes a new cercopid which destroys the flowers of cacao in Panama and in Costa Rica.

The banana aphid (Pentalonia nigronervosa Coq.), W. W. Froggatt (*Agr. Gaz. N. S. Wales, 34 (1923), No. 4, pp. 296, 297, fig. 1*).—A brief account of *P. nigronervosa*, which infests banana plantations in the Tweed River district of New South Wales. The occurrence of the pest in the United States was recorded by Wilson (E. S. R., 22, p. 552) in 1909.

Notes on woolly aphis studies (*Va. State Crop Pest Comn. Quart. Bul., 4 (1922), No. 1, pp. 8, figs. 3*).—This number consists of papers, by several authors, which deal with the woolly aphid.

Some observations on the habits of the woolly apple aphis (Eriosoma lanigerum Haus.) in Virginia, R. R. Reppert (pp. 1–3).—The observations reported, which were made during the early summer of 1918, in the vicinity of Blacksburg, have led to the following conclusions:

"The aerial forms of the woolly apple aphid are reduced normally to a great extent in Virginia by larvae of syrphid flies. In Virginia emergence of fall winged migrants begins about the middle of September, reaches its maximum about October 1, and ceases about October 15. At Blacksburg, Va., migration of winged forms from the elm to the apple takes place from May 15 to about May 30. Colonies may persist at Blacksburg for at least two seasons on the apple without the mediation of forms from the elm. Colonies resulting from spring migrants produce fall migrants the same year." Normally at least 50 per cent of the aphids moving from the twigs to the roots in the fall drop to the ground rather than crawl down the trunk.

Movement of woolly aphis from elm to apple trees, W. J. Schoene and G. W. Underhill (pp. 3, 4).—This is a report of observations made in a nursery at Richmond, in the spring of 1919, with a view to determining the approximate time at which aphids leave the elm and establish themselves on apple. It is pointed out that in Virginia the woolly aphid lives through the winter on the branches and roots of apple trees and may also pass the winter in the egg stage on the bark of the elm. Observations were made on May 22 and 23, at which time the young grafts and seedlings were generally infested. The winged individuals that had recently arrived from the elm were found on nearly every plant, where they were feeding and giving birth to young aphids. On those dates the young elms which were standing in close proximity to the nursery showed that there had been a heavy infestation early in the season, but the leaves were nearly all dry and were absolutely free from aphids at this time. On May 27 a careful search failed to show a single winged individual on the foliage of the grafts or the seedlings, and it appeared that the last spring migrants died previous to that time. On June 2 there appeared to be a large increase in the number of colonies on the roots. On June 9 the aphids continued to move downward to the roots. Observations on June 16 indicated a decrease in the number of aerial colonies.

Spraying apple grafts and seedlings to prevent root infestation by the woolly aphis (Eriosoma lanigerum), G. W. Underhill (pp. 4–7).—Experiments here reported indicate the possibility of woolly aphid control in blocks of apple nursery stock. It appears that timely applications of a spray consisting of 40 per cent nicotin sulphate at the rate of 1 to 400 and rosin fish-oil soap at the rate of 8 lbs. to 50 gal. destroy the newly established aerial colonies and greatly retard root infestation.

Destruction of woolly aphis on roots of apple nursery stock, W. J. Schoene (pp. 7, 8).—This is a report of tests made during the summer of 1920 with calcium cyanamid, potassium cyanid, and solutions of creosote as a means of controlling the woolly aphid on the roots of apple trees in the nursery. The results show that because of the injury to the roots neither potassium cyanid nor calcium cyanamid is of value as a destroyer of woolly aphids. Soluble

creosote, obtained under the trade name Soluble Pinetrex, used at the rate of 1 part to 15 parts of water, 1 qt. per tree, destroyed the aphids without important injury to the roots. There are, however, many practical difficulties being encountered in treating the roots of trees, especially nursery stock, with liquid insecticides.

Mealybugs, W. T. HALL (*Cairo Sci. Jour., 11 (1923), No. 109, pp. 58–67*).—This is a summary of information on mealybugs, with remarks on Egyptian species.

Tolerance of San José scale to sprays, A. L. MELANDER (*Washington Col. Sta. Bul. 174 (1923), pp. 5–52, figs. 2*).—This is a report of investigations commenced in 1908 with a view to determining whether the San José scale varies in its susceptibility to lime sulphur and whether races are being selectively bred that manifest an increasing tolerance to this insecticide.

The author finds that "the abundance of scales at Clarkston and the relative scarceness at Wenatchee are probably largely due to a natural vigor possessed by the Clarkston scales, as manifested by a positive tolerance to lime sulphur, and a corresponding weakness of the Wenatchee scales, as manifested by susceptibility to sprays. The difference is probably due less to external factors, like spraying methods, minimum winter temperatures, optimum summer weather, action of parasites, number of summer generations, or condition of host plants. There is no positive evidence that the San José scale is at present becoming more and more resistant to polysulphid sprays. This is possibly the effect of hereditary regression, since the annual spraying with lime sulphur exerts selection on only one of the season's many generations. Or possibly acclimatization to lime sulphur is an annual acquirement, not necessarily heritable."

Further tests of dry sulphur compounds for the control of the San José scale, W. P. FLINT (*Ill. Nat. Hist. Survey Bul., 13 (1920), Art. 13, pp. 339–343*).—The author reports that two years' work with these materials seem to show that some dry-sulphur compounds, if used at sufficient strength, are effective in controlling the San José scale. From the results of the past season, when Martin-Senour's dry lime sulphur was used at a strength of 12.5 lbs. to 50 gal. of water, it is apparent that these materials should not be used at a strength of less than 15 lbs. to 50 gal. of water.

Budworm infestation v. pulpwood production, A. D. HOPKINS (*Amer. Paper and Pulp Assoc., Woodlands Sect. Proc., 2 (1922), pp. 7, 8*).—This is a discussion of the subject presented before the American Paper and Pulp Association at New York on April 11, 1922, which is followed by excerpts from a paper by F. C. Craighead (pp. 8–10).

Codling moth control in Rogue River Valley, M. A. YOTHERS and E. R. VAN LEEUWEN (*Better Fruit, 17 (1923), No. 11, pp. 7, 8, 20, 23, 24, figs. 2*).—This is a brief summary of the results of work conducted in Rogue River Valley, Oreg., a detailed account of which is to be published in bulletin form.

The survey of Myelois venipars Dyar in Arizona, P. A. GLICK (*Ariz. Comn. Agr. and Hort. Ann. Rpt., 14 (1922), pp. 78–97, figs. 24*).—This is a report of studies of the Arizona navel orange worm, a survey of which was made from July, 1921, to March, 1923, and an account of which by Mote has been noted (E. S. R., 49, p. 155).

It is pointed out that F. H. Gates, in observations covering a period from August to December, 1921, found larvae in practically every grove visited, and concluded that the feeding habits of the larvae were such as to make it a potential pest of considerable importance, whereas R. Jones, who continued the survey from January to the last of March, 1922, found no larvae in the fallen

oranges during that time. In observations in groves made from May 20 to June 1, D. C. George failed to detect the presence of the larvae. In investigations continued by J. H. O'Dell no larvae were found until July 27, at which time they occurred in abundance, and he was led to conclude that the larva is a secondary pest, attacking only such fruit as would not be salable as first-class fruit.

The paper includes a discussion of its importance, life history and habits, and natural enemies. The larvae have not been observed to be parasitized, but a parasite destroys some 70 per cent of the eggs.

The tea leaf skeletonizer, J. C. Hutson (*Trop. Agr. [Ceylon], 60 (1923), No. 2, pp. 81–83, pl. 1*).—A preliminary note on this caterpillar pest of tea in the Ramboda and Badulla districts of Ceylon.

Resistance of wheat varieties to Hessian fly injury (*Kansas Sta. Bien. Rpt. 1921–22, pp. 20, 21*).—The results of field experiments on the resistance of wheat varieties to Hessian fly injury, which have been under way for several years, are summarized as follows:

"There is practically no discrimination by the adults in ovipositing, and eggs are deposited in about equal numbers on all varieties of wheat. There is a decided difference in the subsequent infestation, and certain varieties exhibit marked resistance. Such varieties as Illini Chief, Dawson Golden Chaff, Beechwood Hybrid, Currell Select, and Dietz have been consistently free from injury. Other varieties, as Turkey, Kharkov, Ghirka, Zimmerman, and Marquis, have been very susceptible under all conditions. Such varieties as Kanred, Fulcaster, and Clark Blackhull have been erratic, being apparently resistant in one test and very susceptible in another. There has been a marked difference in the behavior of strains of the same variety. Fifty strains of Illini Chief have been under observation, and two of these have been susceptible, while the remainder have been very resistant."

An extended study made of the morphological characters of the wheat plant which might be associated with the fly's activity indicates that resistance is not associated with morphological characters. Preliminary results indicate that the silica content of the plant may have a decided influence on the ability of the plant to resist Hessian fly injury.

Root maggots and their control, R. C. Treherne (*Canada Dept. Agr. Pamphlet 32, n. ser. (1923), pp. 8, figs. 5*).—This practical summary of information on control measures is a revision of an earlier account.[1]

Two Asiatic muscoid flies parasitic upon the so-called Japanese beetle, J. M. Aldrich (*U. S. Natl. Mus. Proc., 63 (1923), Art. 6, pp. 4*).—Descriptions are given of *Ochromeigenia ormioides* Town., which is said to deposit larvae, and *Centeter cinerea* n. g., n. sp., both of which parasitize *Popillia japonica* Newm. in Japan.

A new parasitic fly bred from the bean beetle, J. M. Aldrich (*Ent. Soc. Wash. Proc., 25 (1923), No. 4, pp. 95, 96*).—Under the name *Paradexodes epilachnae*, the author describes a new dipterous parasite reared in large numbers at Coapa, D. F., Mexico, in late summer and fall in 1922 from larvae of the bean beetle (*Epilachna corrupta* Muls.). Attempts are being made to introduce this parasite into the region of Birmingham, Ala.

Heredity in the honeybee, P. W. Whiting (*Jour. Heredity, 13 (1922), No. 1, pp. 2–8, figs. 4*).—This is a brief general discussion of the subject.

Studies of ants, II, III, A. Forel (*Le Monde Social des Fourmis du Globe Comparé à Celui de l'Homme. Geneva: Libr. Kundig, 1921, vol. 2, pp. III+184, pls. 4, figs. 38; 1922, vol. 3, pp. VII+227, pls. 10, figs. 28*).—In the second of

[1] Canada Dept. Agr., Ent. Branch Crop Protect. Leaflet 4 (1918), pp. 4.

the five projected volumes of this work on ants (E. S. R., 45, p. 762), the author deals with their senses (pp. 1–46), physiology and psychology (pp. 47–60), interrelation with plants, symbiosis (pp. 61–73), animal guests or myrmecophilism, mimicry (pp. 74–117), parasites, toxicology, and monstrosities (pp. 118–134), and nests of ants (pp. 135–178).

Volume 3 deals with the social life and habits of the ants, including an account of methods of observation. It contains an appendix by E. Bugnion on The Warfare of Ants and Termites; the Origin of Instincts Developed by This Strife (pp. 173–225).

The large larch sawfly (Nematus erichsonii), A. I. Dobrodeev (*Selsk. Khoz. Uchen. Kom., Izv. Otd. Prikl. Ent. (Rpts. Bur. Appl. Ent. Agr. Sci. Com.), 1 (1921), pp. 100–128, pl. 1*).—This is a report of studies of *N. erichsonii*, which occurs in considerable numbers in central Russia.

Feeding habits of the Japanese beetle which influence its control, L. B. Smith (*U. S. Dept. Agr. Bul. 1154 (1923), pp. 12, figs. 3*).—After briefly discussing the difficulty of controlling the Japanese beetle (*Popillia japonica* Newm.), the author deals with its feeding habits, movements of the beetles in relation to their food plants, the process of infestation, proportion of sexes on various types of food plants, and the rate at which the beetles feed.

The pest has been recorded as attacking 210 species of plants, but its most severe injury is confined to between 20 and 25 species, including most of the cultivated fruit trees, corn, and beans, besides various shade trees and ornamental shrubs. The degree of infestation of its food plants is variable, instances having been noted on peach, smartweed, sassafras, and apple where the plants were heavily infested for a while, after which the beetles left for other food plants and in some cases the plants were not again infested during the season.

"Ripening fruit of any kind, silk and ears of corn, and peaches affected with brown rot are particularly attractive to the beetles. So numerous do the insects become at times that prematurely ripened peaches and apples are completely covered with a swarming mass of beetles. During the early part of the season the beetles are more abundant on weeds, cherries, and grapes; by midsummer, fruit and shade trees are more heavily infested, while during August and September heavy infestations are mostly confined to corn, beans, clover, and various plants in bloom at that time. Most of the feeding occurs on the upper and outer foliage of the various food plants, especially where they are exposed to the direct rays of the sun."

The Japanese beetle, C. H. Hadley (*N. J. Dept. Agr. Circ. 46 (1922), pp. 20, figs. 11*).—This summary of the status of knowledge of the Japanese beetle and of control work under way is a revision of Circular 30.[1]

Annual report of the entomology department, R. W. Harned (*Mississippi Sta. Rpt. 1922, pp. 19–23*).—The damage caused by May beetles (*Phyllophaga* (*Lachnosterna*) spp.) to pecan trees led to a special study of the group, 22 species having been found during 1921 feeding upon pecan trees. About 42 species have thus far been recorded from the State. In one orchard, in which May beetles have been trapped at night for several years by means of lanterns placed over tubs of oil and water, the damage was less than in previous years, although the May beetles apparently caused more injury to pecan trees throughout the State than in any previous year.

The striped cucumber beetle and how to control it, F. H. Chittenden (*U. S. Dept. Agr., Farmers' Bul. 1322 (1923), pp. II+16, figs. 16*).—This is a revision of Farmers' Bulletin 1038, previously noted (E. S. R., 41, p. 259).

[1] N. J. Dept. Agr. Circ. 30 (1920), pp. 33.

The fringed nettle grub, Natada nararia Moore, J. C. Hutson (*Trop. Agr. [Ceylon], 60 (1923), No. 2, pp. 77–81, pl. 1*).—This paper deals with an insect which has been known as a pest of tea in Uva for at least 25 years. Occasional outbreaks have occurred at intervals in other districts.

The destruction of weevils and other insect enemies of stored grain and legumes, A. Piedallu (*Ann. Sci. Agron. Franç. et Étrangère, 39 (1922), No. 6, pp. 353–365, figs. 5*).—This is a general discussion of the subject. The author recommends the treatment of the stored grain with chloropicrin at the rate of 10 to 30 gm. per cubic meter of space. He finds that the germination is not affected by this treatment.

Otiobiosis (ear tick disease), N. Toomey (*Laryngoscope, 31 (1921), No. 12, pp. 930–937, figs. 4*).—The author reviews the literature on infestation of the ear by the spinose ear tick, *Otiobius (Ornithodoros) megnini* Dug., and reports upon ear infestation of man, including a case personally treated. A list is given of 23 references to the literature cited.

Pediculopsis graminum Reut., the cause of white-ear of rye, V. P. Pospelov (*Selsk. Khoz. Uchen. Kom., Izv. Otd. Prikl. Ent. (Rpts. Bur. Appl. Ent. Agr. Sci. Com.), 1 (1921), pp. 62–79, pls. 2*).—This is an account of *P. graminum*, which the author observed on rye and oats in the Voronej Government in 1920, when up to 50 per cent of all plants were affected. It was found to occur with *Sporotrichum poae*, of which it seems to be an active disseminator.

The dermanyssid mites of North America, H. E. Ewing (*U. S. Natl. Mus. Proc., 62 (1922), Art. 13, pp. 26, pls. 2, figs. 7*).—Keys are given for the separation of subfamilies and genera of Dermanyssidae, which are parasitic on vertebrates, together with descriptions of 10 genera recognized, of which 6 are erected, and of the species, of which 11 are described as new.

Tularaemia Francis 1921, a new disease of man (*U. S. Pub. Health Serv., Hyg. Lab. Bul. 130 (1922), pp. VII+87, pl. 1, figs. 2*).—The eight papers here presented consist of the seven numbered papers previously noted (E. S. R., 46, pp. 151, 152, 662, 663; 47, p. 559) and Cultivation of *Bacterium tularense* on Three Additional Mediums New to This Organism, by Francis (E. S. R., 47, p. 486).

FOODS—HUMAN NUTRITION.

The action of shortening in the light of the newer theories of surface phenomena, W. Platt and R. S. Fleming (*Indus. and Engin. Chem., 15 (1923), No. 4, pp. 390–394*).—In this paper the authors attempt to explain the difference between the shortening powers of various fats from the standpoint of modern theories of physical chemistry. In the discussion the term shortening is used as defined by Davis (E. S. R., 46, p. 258). Since the details of the action of shortening are quite different in different baked products, sugar cookies are taken as an example, and the discussion is confined to the physical effects of the shortening on the structure and physical properties of the dough and finished product.

A minute description is first given of the processes involved in mixing and baking the dough, and the physical changes accompanying each step of the process, with particular reference to the location of the shortening during the process. From microscopic examination of the properly stained dough and finished products, the conclusion is drawn that the shortening acts by interposing itself in layers between the particles of dough, thus acting somewhat as a lubricant and preventing contact between particles of the dough. The shortening not only acts as a thin film of oil holding apart solid masses, but adheres to them so closely that it can not be forced out by pressure.

The common fats arranged in decreasing order of their shortening power are given as lard, lard compound, cottonseed oil, butter, and coconut oil, and below these vaseline and purified petroleum oils. Among the factors which are considered to play a part in giving these fats and oils differences in shortening power are viscosity, surface tension of the oil against air, melting point and plasticity, and surface tension of oil against water. The latter is considered one of the most important factors in determining the shortening power of a fat. From present conceptions of the action of oil films on water, it is considered that shortening containing double bonds should cover a greater aqueous surface and adhere more closely to such surfaces than shortenings without double bonds, or that, other factors being equal, shortenings should be arranged in the order of their percentage of unsaturated glycerids. The order of some of the common shortening agents thus arranged is cottonseed oil, lard, lard compound, butter, coconut oil, and liquid paraffin. With the exception of lard and lard compound this order is practically the same as the order of their actual shortening power. The superior shortening power of lard is attributed to its greater plasticity.

Absorption and retention of hydrocyanic acid by fumigated food products, E. L. GRIFFIN, I. E. NEIFERT, N. PERRINE, and A. B. DUCKETT (*U. S. Dept. Agr. Bul. 1149 (1923), pp. 16, pl. 1*).—This publication reports the results of an investigation of the amount of hydrocyanic acid absorbed under ordinary conditions of fumigation by various fruits, vegetables, and seeds, and of the rate at which the gas is given off on exposure of the products to air.

The fruits and vegetables, bought in season in the open market, were divided into three lots, one of which was analyzed without being fumigated, the second fumigated at normal atmospheric pressure by the "pot" method, and the third fumigated by a modification of the vacuum method of Sasscer and Hawkins (E. S. R., 32, p. 650). Part of the material was analyzed immediately after fumigation and part stored in the refrigerator for 24 hours before being analyzed. The hydrocyanic acid determinations were made after distillation with tartaric acid by the method of Viehoever and Johns (E. S. R., 34, p. 11).

All of the fumigated fruits and vegetables absorbed some hydrocyanic acid. In general the greatest absorption occurred in the fruits and vegetables of a succulent nature or containing much chlorophyll, while there was comparatively little penetration of the gas into the flesh or edible parts of hard-skinned products such as apples and citrus fruits. No direct relationship appeared to exist between the quantity of hydrocyanic acid absorbed and the damage to the tissues. Some of the materials, such as green peas and string beans, which absorbed the largest quantities of gas showed no deterioration, while others, such as pears and cantaloups, absorbed very little but deteriorated rapidly.

In the work with seeds and flour, in addition to the points investigated with fruits and vegetables, studies were made of the rate at which the gas was dissipated on storage, the effect of evacuating the chamber several times after fumigation, and the relation of the concentration of the fumigant to the quantity absorbed. The materials tested included navy beans, white field corn, cowpeas, wheat, and flour, all of which were fumigated in amounts of 15 lbs.

All of the seeds absorbed hydrocyanic acid in rather large amounts, most of which disappeared within 4 days. After this the disappearance was very slow, a small amount being present at the end of 3 months. The disappearance of hydrocyanic acid from the flour was more rapid than from the seeds, no traces of it being present at the end of a week. Evacuating the chamber after fumigation did not tend to remove the absorbed hydrocyanic acid. The con-

centration of the gas had a marked effect on the quantity absorbed by the product. This was noticeable even after 3 months.

A table is included of the absorption of hydrocyanic acid in other miscellaneous products, including beans, cottonseed and its products, cowpeas, chestnuts, and honey. There was a surprisingly small absorption of hydrocyanic acid by uncapped honey.

The basal metabolism of girls from eleven to fourteen years of age, M. S. Rose and G. MacLeod (*Amer. Jour. Physiol., 63 (1923), No. 3, pp. 399, 400*).—This is a summary of a series of basal metabolism determinations made with the Benedict portable respiration apparatus on 34 subjects, 4 aged 11 years; 15, 12 years; 10, 13 years; and 5, 14 years. In all cases at least two observations 6 months apart were made, and 7 of the children were followed for 2 years with determinations every 6 months. The ranges of metabolism for the different ages calculated in calories per square meter per hour are as follows: Eleven years 35.9–42.5, 12 years 31.3–51.6, 13 years 35.9–49.1, and 14 years 31.8–41.4.

Potato flour in infant feeding, E. Müller (*Klin. Wchnschr., 1 (1922), No. 48, pp. 2378–2380*).—The author recommends the use of potato flake flour in place of wheat flour as the foundation material for the preparation of various infant foods. The flour is prepared by cleaning and shredding raw, unpeeled potatoes, drying them at 40° C. (104° F.), and then grinding to a fine powder which is subjected for a short time to a temperature of 50 to 55° to dextrinize somewhat the starch. For the flour the following composition is reported: Water 10.19, dry substance 89.81, ash 4.15, organic matter 85.66, protein 8.3, fat 0.21, crude fiber 3.06, carbohydrate 73.19, and soluble matter 9.72 per cent. The ash constituents are given as K_2O 2.12, Na_2O 0.09, CaO 0.12, MgO 0.14, P_2O_5 0.57, SO_3 0.35, Cl 0.12, and SiO 0.26 per cent. Compared with potato starch and wheat flour, the potato flour is characterized by its high ash content and is also considered to be richer in vitamins.

It is stated that in a hospital ward of about 35 children this flour has been used for several months in place of wheat flour in the preparation of various infant foods. With the exception of a few cases in which the flour appeared to have an irritating effect on the intestines, no harmful effects were noted. The stools were somewhat more voluminous than when wheat flour was used, and the urine had a strongly alkaline reaction.

Calcium absorption in children on a diet low in fat, L. E. Holt and H. L. Fales (*Amer. Jour. Diseases Children, 25 (1923), No. 3, pp. 247–256*).—The evidence presented in this paper supplements and confirms the authors' previous observations that the best absorption of calcium in children takes place when the intake of fat is at least 3 gm. for each kilogram of body weight and that of calcium is in the proportion of 0.03 to 0.05 gm. of calcium oxid for each gram of fat (E. S. R., 42, p. 661; 47, p. 766).

The calcium metabolism was determined in 7 healthy children from 2 to 6 years of age while on a diet furnishing this proportion of fat and calcium. The fat was then removed from the diet so far as possible and the loss in calories made up by extra carbohydrate. After the children had been kept on this diet for a week or more the calcium balance, and in some cases the fat balance, was determined. Case reports include not only metabolism data but the appearance of the stools.

In all cases the character of the stools changed from normal in appearance to acid and foul, with excess of fermentation and undigested food residues. In 5 of the 7 cases the calcium absorption was reduced when the low fat diet was taken, a negative balance resulting in 3 cases. In the other 2 cases the

stools were not entirely normal during the control period and showed no change on the low fat diet.

"Although the results of these observations are not entirely uniform, the indications are that a low fat diet greatly diminishes calcium oxid absorption. Whether the absorption of calcium oxid is dependent on a definite relation between the fat and calcium in the diet, or whether the fat intake influences the calcium oxid absorption chiefly by the maintenance of proper digestive conditions, it is impossible to say. It is quite certain that a very low fat intake brings about abnormal digestive conditions, as judged by the type of stool. Finally, it seems safe to conclude that the conditions for proper calcium absorption are much better when the fat intake is generous."

The excretion of uric acid on a purin-low diet, H. STEUDEL (*Hoppe-Seyler's Ztschr. Physiol. Chem., 124 (1923), No. 3–6, pp. 267–273*).—In connection with some metabolism experiments to test the relative utilization of various breads, the author was given the opportunity to analyze the urine of two subjects whose diet for two experimental periods of 5 days each consisted of 1,000 gm. of bread, 50 of sugar, and 40 of butter, and as a beverage an infusion of 2,000 cc. of water with 15 gm. of bean coffee and 15 of malt coffee. Between the two periods there was a free day on a milk diet of 1½ liters. The urine was analyzed daily for total nitrogen by the Kjeldahl method and for creatinin and uric acid by the Folin colorimetric method.

The values for creatinin corresponded more or less closely with those reported in the literature, but the uric acid values were extremely variable, fluctuating in one subject from 0.025 to 0.56 gm. daily, and in the other from 0.017 to 0.51 gm. In an effort to explain these wide variations an examination was made of the feces, and it was found that the feces for the days on which there was a very low output of uric acid showed marked fermentation, with gas formation on heating, and that on these days there had been digestive disturbances with marked gas formation in the intestines. This fermentation is thought to have resulted in the decomposition of purin bases in the intestinal canal. The data are also thought to indicate that the so-called endogenous purin comes from the digestive juices and the intestinal epithelium.

The effect of a restricted diet, I–III, J. R. SLONAKER and T. A. CARD (*Amer. Jour. Physiol., 63 (1923), No. 3, pp. 503–512, figs. 2; 64 (1923), No. 1, pp. 35–43, 167–180, figs. 12*).—The complete report of an investigation covering more than 8 years on the effects of the vegetarian diet on growth, the ability to reproduce, and the number and character of the young is presented in the following papers:

I. *On growth* (pp. 503–512).—The general plan of the experiment is described in an earlier paper (E. S. R., 39, p. 672). The diet in both the control and restricted groups of rats consisted of cracked yellow corn and table scraps supplemented with fresh vegetables. In the control groups these were supplemented still further by the addition of some form of animal protein two or three times a week. The scraps for the other groups were carefully sorted to remove as far as possible all bits of meat and other forms of animal protein. In the experimental data reported five groups are considered: (1) The control rats or omnivorous feeders, (2) the matings in which both male and female were selected from the omnivorous stock and had been on an omnivorous diet until the time of mating, (3) matings in which 1 rat was taken from the control stock and its mate from the offspring of the restricted feeders, (4) matings in which both sexes were from the young of restricted feeders and which had been on a restricted diet since birth, and (5) certain restricted feeders which, toward the end of the experiment, were changed to

the omnivorous diet. The principal conclusions drawn from this phase of the investigation are as follows:

On the restricted diet the maximum weight of the oldest males and females averaged 35 per cent and from 25 to 28 per cent below the control males and females. This maximum weight was reached at an earlier age in the restricted group than in the controls and at an earlier age in the males than in the females of the same class. The average length of life was shorter in the restricted group than in the controls. Both weight and length of life of the restricted feeders were increased by adding animal protein to the diet.

The young of the restricted feeders averaged 18 per cent for males and 14.5 per cent for females below the average of the corresponding sexes of the controls. The effect of the restricted diet became greater with increasing age until about the two hundred and fiftieth day.

II. *On pubescence and the menopause* (pp. 35–43).—In the animals on the restricted diet there was delayed pubescence, shortening of the period of sexual activity, and increase in sterility of over four times the normal, and this was more marked in females than in males. All the differences were most marked in the animals kept for the longest time on the restricted diet and were reduced by the addition of animal protein to the diet.

III. *On the number of litters and young born* (pp. 167–180).—The effects of the restricted diet on reproduction are summarized as follows:

"A great number of animals became impotent. The fecundity of the animals was greatly reduced. The animals lost the power of reproduction by the third generation, and the line of descent became extinct. Animals still capable of reproduction were restored to nearly normal conditions by an omnivorous diet."

Metabolism on a vitamin-free diet, M. Tsuji (*Biochem. Ztschr., 129 (1922), No. 1–2, pp. 194–207, fig. 1*).—This is the complete report of an investigation which has been previously noted in a paper by Bickel (E. S. R., 47, p. 265).

Food value of milk (*Oklahoma Sta. Rpt. 1922, pp. 14, 15*).—It is reported that evidence has been obtained that raw milk is superior in its nutritive value to milk pasteurized in closed bottles, but that the latter is superior to milk pasteurized in open vats. Some evidence has also been obtained that the vitamin value of milk produced from cows fed on grain sorghum silage is superior to that produced by cows which have been fed on grain sorghum stover. This is thought to indicate that the vitamins are not destroyed in the silage, but are destroyed to some extent in the process of drying in the formation of stover.

The effect of formaldehyde upon the vitamin content of milk, A. M. Bleile and R. J. Seymour (*Amer. Jour. Physiol., 63 (1923), No. 3, pp. 421, 422*).—The addition of formaldehyde to milk in the proportion of 1:20,000 was found to have no deleterious effect on the vitamin content of the milk as determined by feeding experiments with young chickens.

The laxative action of yeast, J. R. Murlin and H. A. Mattill (*Amer. Jour. Physiol., 64 (1923), No. 1, pp. 75–96*).—The authors define laxative action as "either an easier evacuation on account of increased moisture in the stool or more complete evacuation on account of stimulation to peristalsis or greater bulk of residue." To determine whether yeast has any laxative effect according to this definition, three series of experiments were conducted as follows:

In the first, 10 students were placed on a nearly constant diet alternately in 7-day periods with or without yeast in amounts of ½ yeast cake a meal in the first series and 1 a meal in the second series. The stools were collected, samples dried to constant weight, and the percentage of moisture and solids determined. In the second, 5 subjects received a more rigidly constant diet with and without

yeast in alternate periods of shorter duration, the amounts of yeast being increased from 1½ to 3, and finally to 6 cakes daily. In this series, in addition to the determinations made as in the first series, the stools were also analyzed for total nitrogen and phenols, and the urine was analyzed for total nitrogen, free and conjugated phenols, and uric acid. In the third series 2 dogs were used as subjects and determinations made of the nitrogen output on diets with and without yeast.

In the first series there was no evidence of increased moisture content, but there was a measurable increase in the bulk of the stool as the result of taking yeast. This effect persisted for several days after the ingestion of yeast was stopped. In the second series a laxative effect was evident both by increased weight and increased moisture in most of the tests. In general there was not only an increase in the absolute amount of nitrogen eliminated, but also in the percentage of nitrogen. This and the values for total nitrogen in the urine gave evidence of the utilization of the protein of the yeast. There was a consistent though small relative decrease in the phenol content of the stools following ingestion of yeast and a marked increase in the uric acid of the urine. Boiled yeast, while more easily digested than raw yeast, did not have so laxative an effect as raw yeast.

Four cakes of yeast gave a marked laxative effect when fed to dogs of 9 and 10 kg. weight on a constant diet which was otherwise slightly constipating. The yeast protein appeared to be well utilized by dogs.

Food accessory factors (vitamins) in bacterial growth.—VII, Observations on the ultimate source of accessory growth substances for yeast, R. C. Robertson and D. J. Davis (*Jour. Infect. Diseases, 32 (1923), No. 2, pp. 153–158*).—In this continuation of the series of studies previously noted (E. S. R., 46, p. 80), an attempt has been made to determine whether yeast is able to synthesize its own growth-promoting substance. The basal medium used throughout consisted of chemically pure asparagin 3.4 gm., calcium chlorid 0.1, dextrose 20, magnesium sulphate 0.2, potassium phosphate (K_2HPO_4) 1, and sodium chlorid 5 gm., with sterile distilled water to make 1 liter. These materials were dissolved by boiling for 3 minutes and the original volume then restored with distilled water and the reaction adjusted to pH 7.4, after which the medium was tubed and autoclaved at 20 lbs. pressure for 30 minutes. The original yeast was obtained from a Fleischmann yeast cake and was grown in pure culture on dextrose agar slants and centrifuged three times with physiological salt solution before using. Cold water extracts were made of beef heart, carrot, and potato, each being passed through a Berkefeld filter. A killed yeast suspension containing about 500,000 cells per cubic millimeter, was allowed to autolyze for one week at 37.5° C. and then passed through a Berkefeld filter. Tubes, each containing 2 cc. of the mediums tested, which included the synthetic medium both alone and with each of the various extracts, sterile physiological salt solution with each of the extracts, and dextrose broth, were inoculated with a 3 mm. loopful of the washed yeast and tested every 24 hours for growth on dextrose agar slants, transplants being made in all positive cases.

In all cases positive growth was obtained for a few generations. On the controls of salt solution plus the aqueous extracts, growth continued for only 2 or 3 generations, and on the synthetic medium alone growth occurred with diminishing luxuriance for from 12 to 15 generations. With the four aqueous extracts there was luxuriant growth for 50 generations when the extract and medium were in equal concentration. At a concentration of the extract below 1 to 500 growth ceased after a few generations, but concentrations above 1 to 500 gave no better results than at this concentration.

It is concluded that yeast is incapable of synthesizing its own growth-stimulating substance or substances, but that yeast cells to a large extent possess the power of utilizing these essential food substances when present in small amounts in the medium.

Studies of the vitamin of cod liver oils.—I, The potency of crude cod liver oil, pressed cod liver oil, and cod liver stearin, A. D. HOLMES (*Jour. Metabolic Research, 2 (1922), No. 1, pp. 113–122, figs. 3*).—In this study of the relative potency in vitamin A of crude cod-liver oil, pressed cod-liver oil, and cod-liver stearin, 13 rats weighing from 75 to 100 gm. each were transferred from a stock diet of dog biscuit and reconstituted skim-milk powder to a vitamin A-deficient ration consisting of casein 18, cottonseed oil 22, salt mixture 4, corn starch 28, and lactose 28 per cent, with a 0.2 gm. tablet of dried brewery yeast daily. When the animals had ceased to grow on this diet they were given graduated doses of the various cod-liver oils diluted with peanut oil. To administer the oil the yeast tablets were crushed in small porcelain dishes and then allowed to absorb the required amount of oil. The oils tested were secured from a nearby rendering station, the pressed oil and stearin being obtained from the same source as the crude oil.

Five animals were fed the diluted crude oil in doses representing 0.00183, 0.00366, 0.00549, 0.00732, and 0.00732 gm., respectively; 4, the pressed oil in doses of 0.00191, 0.00382, 0.00573, and 0.00764 gm.; and 4, the stearin in doses of 0.00178, 0.00356, 0.00534, and 0.00712 gm. So far as can be judged in a comparison of single rats on different amounts the pressed oil had a higher potency than either the crude oil or stearin, the minimum amounts of the three oils for satisfactory growth being 0.00366 of the crude oil, 0.00191 of pressed oil, and 0.00356 gm. of the stearin. It is emphasized, however, that "much more extensive data are required to furnish conclusive evidence concerning the minimum amount of these oils necessary to supply an adequate amount of vitamin A for the dietary needs of the growing albino rat."

The pathological anatomy of ophthalmia produced by diets containing fat-soluble A, but unfavorable contents of certain inorganic elements, S. MORI (*Amer. Jour. Hyg., 3 (1923), No. 2, pp. 99–102, pl. 1*).—A description is given of the histological changes in the eyes of rats which, as previously noted by McCollum et al. (E. S. R., 48, p. 464), developed an ophthalmia on diets containing a sufficiency of vitamin A but unfavorable salt mixtures. This condition is shown to be identical pathologically as well as clinically with the ophthalmia induced by lack of vitamin A. "It would seem from the foregoing experiment that in cases of xerophthalmia which occur in human beings other factors than fat-soluble A may have to be considered in regard to the etiology and treatment of the condition."

The relation of vitamin C to bacterial infection, G. M. FINDLAY (*Jour. Path. and Bact., 26 (1923), No. 1, pp. 1–18, pl. 1*).—Guinea pigs in a state of so-called chronic scurvy, induced by the feeding of a basal diet lacking vitamin C, but supplemented by insufficient amounts of orange juice, were injected intraperitoneally with four species of pathogenic bacteria, and the effects of these injections compared with those obtained following similar injections in normal guinea pigs. Two points in particular were considered: (1) The number of organisms and the time required to produce a fatal result, and (2) the cellular reaction to the infection as shown by changes in the blood, bone marrow, and lymph tissue. For purposes of comparison, a description is given of the appearance of these organs in acute and chronic scurvy uncomplicated by bacterial infection.

The results of the investigation are thought to indicate that guinea pigs fed on a diet deficient in vitamin C succumb to a smaller infecting dose of

bacteria than animals on a complete diet. In chronic scurvy a degeneration in the blood forming bone marrow is present, and it is thought possible that this lesion in the bone marrow is one of the factors responsible for the reduction of resistance to bacterial infection.

The action of tyramin on pigeon beriberi, W. LIPSCHITZ (*Hoppe-Seyler's Ztschr. Physiol. Chem., 124 (1923), No. 3–6, pp. 194–201, figs. 3*).—Tyramin or *p*-oxyphenylethylamin, a substance capable of increasing the respiration of isolated frog muscle, was injected in doses of 5 mg. of the crystallized hydrochlorid dissolved in 1 cc. of water into the breast muscles of several pigeons which had developed severe symptoms of polyneuritis on a polished rice diet. In 4 of these pigeons the injection had a favorable effect on the course of the disease as noted by relief of clinical symptoms and gain in weight. In 5 other cases no favorable results were obtained. In most of the cases in which there was a favorable outcome following the first injection, similar results were not obtained after the symptoms had reappeared following the continuation of the polished rice diet. In no case was it possible to prevent the onset of polyneuritis by the use of tyramin as a prophylactic. Hordenin sulphate, a derivative of tyramin, showed no curative properties.

Changes in the temporal bones in experimental rickets.—Their relation to otosclerosis, A. B. KAUFFMAN, F. CHEEKMUR, and O. T. SCHULTZ (*Jour. Amer. Med. Assoc., 80 (1923), No. 10, pp. 681–685, figs. 5*).—A description is given, with illustrative microphotographs, of the pathological changes occurring in the bony structure of the inner ear of young rats maintained for some time on a diet low in vitamin A and in calcium. These changes are considered to be identical with the changes in the long bones which are characteristic of rickets and to represent an acute form of otosclerosis.

In discussing the significance of these findings, the authors state "we feel justified in calling attention to several points hitherto unrecognized both by pediatricians and workers in the problem of rickets, and also by the otologist: That changes in the temporal bone in rickets are important ones, since they are concerned with structures essential to the function of hearing, and, secondly, that with such changes there may be a type of deafness either initiated very early in life or remaining latent until the healing process is complete, that has for its etiologic basis dietary deficiencies. This may help to throw some light on the vast number of impaired hearing cases found in children and not ascribable in their entirety to any of the entities in the present day classification of deafness."

What every canner should know (*Natl. Canners Assoc. Bul. 89 A [1922], pp. 31*).—This report of the research committee of the National Canners Association includes recommendations to the canning industry concerning sanitation, processing, coding, incubation, and storage to safeguard against botulism; an outline of the food poisoning investigations upon which these recommendations are based and which were financed by the National Canners Association and conducted in various research laboratories throughout the country; and a brief summary of the results of these investigations, which have an important bearing on the canning industry. Most of the papers in which are given the original reports of these investigations have been noted previously.

ANIMAL PRODUCTION.

A simple formula giving the number of individuals required for obtaining one of a given frequency, H. J. MULLER (*Amer. Nat., 57 (1923), No. 648, pp. 66–73*).—A formula for calculating the number of individuals necessary to

obtain any type in a certain population has been worked out for varying degrees of certainty:

$$n = -\log_e F\ (P - \tfrac{1}{2})$$

n=the number of individuals necessary, F=the chance of success, i. e., 99 times in 100, and P is the number of individuals in the complete population. The formula may be transposed for different purposes.

A Black Leghorn which turned white, F. A. E. Crew (*Jour. Heredity, 13 (1922), No. 7, pp. 299–303, figs. 4*).—A Black Leghorn hen which gradually took on male characteristics and later showed white feathering is described from the University of Edinburgh. The bird had a good egg record herself, but stopped laying, had a much enlarged comb, and did some crowing. At each successive molt more of the black feathers would come in white so that in less than 18 months the feathers were all white except for a few irregular splashes of black. When the bird died it was found to contain a large ovarian tumor, the ovaries were almost entirely atrophied, and no trace of the adrenals was found.

A waltzing rabbit, L. J. Cole and D. G. Steele (*Jour. Heredity, 13 (1922), No. 7, pp. 291–294, pl. 1*).—An account is given of a waltzing rabbit which was observed at the Wisconsin Experiment Station. The rabbit's grandsire was killed with lead poisoning, being used in an experiment in which lead acetate was administered. His great grandsire was used in an experiment to study the effect of alcohol on the germ cells. It is assumed that the waltzing rabbit was inbred, as all the grandparents were probably offspring of the same male.

The waltzing rabbit lived to be nearly six years old and was mated as frequently as possible with related females. The progeny were mated back to him and among themselves, but only one individual with anything like the same characteristics resulted. It is concluded that the condition was not analogous to the waltzing condition in rats and mice, but was more likely due to an injury of a general nature to the germ cells of his ancestors by the lead or alcohol poisoning.

Note on a case of unilateral cryptorchism in the ram, H. B. Fell (*Jour. Roy. Micros. Soc., 1923, No. 1, pp. 62, 63, pl. 1*).—The histological structures of the testes of a ram are described in which only one testicle was in the scrotum. The abdominal testicle was much atrophied and in an early stage of colloidal degeneration. The scrotal testicle was normal but was not in a very active condition.

The influence of the gonad hormones on the seminal vesicles, N. F. Fisher (*Amer. Jour. Physiol., 64 (1923), No. 2, pp. 244–251*).—In studying the function of the seminal vesicles, rats and guinea pigs were used at the University of Chicago. No spermatozoa were found in the seminal vesicles of 20 rats and 20 guinea pigs examined immediately after death or in 10 rats placed in an incubator for 3 to 5 hours after death. Male guinea pigs placed with females, some of which were allowed to copulate, were examined and only in one case, and this after several copulations, were spermatozoa found in the seminal vesicles. In guinea pigs the histological changes in the seminal vesicles were observed from birth until the secretions started at 7 days of age, as well as after copulations. When the seminal vesicles were grafted in other parts of the body the same secretions were produced.

By castrating 15 rats at different ages, it was found that removing one testicle caused no change, but following the removal of both testicles there was an atrophy of the lumen of the seminal vesicles and an hypertrophy of the muscular layer. Ovaries were successfully grafted subcutaneously and intraperitoneally in normal males, and were growing from 3 to 5 months after the

operation without showing any effect of sex gland antagonism, or producing any change in the normal appearance or action of the seminal vesicles.

Feeding value of grain sorghums (*Oklahoma Sta. Rpt. 1922, p. 15*).—Studies of the feeding value of grain sorghums of different colors indicate that color has nothing to do with the vitamin content, as in corn. It has also been shown that ensiling grain sorghums has no effect on the digestibility or vitamin content of the grain when separated from the silage.

Losses which occur in formation of silage, C. W. TURNER (*Jersey Bul. and Dairy World, 42 (1923), No. 17, pp. 823, 824, 860–862*).—This is a brief history of the progress which has been made in the preservation of green forage in silos. The advantages of this method of preservation and the changes in composition which occur are discussed. The principal loss of nutrients is in soluble sugar.

Microbiology of sweet clover silage, bacteriological department (*Ontario Dept. Agr. Bul. 296 (1923), pp. 13–15*).—The bacteria, yeast, and molds in sweet clover silage were determined by the use of various media. The temperature and acidity of the silage were also determined at the time of sampling.

It was concluded from the results of the study that sweet clover silage packed in a silo first undergoes an acid fermentation which checks or destroys the action of putrefactive bacteria by the rise in temperature. Molds are prevented from growing by the exclusion of the air, and yeasts likewise do not find a satisfactory condition for growth.

Factors influencing the composition of body fat (*Kansas Sta. Bien. Rpt. 1921–22, pp. 17, 18*).—Studies of the effect of certain feeds in rations on the production of firm flesh (E. S. R., 46, p. 475) have indicated "that none of the short-chain fatty acids in the food are deposited in the body fat, while the unsaturated fatty acids of the food are so deposited, thus causing the body fat to have a low melting point."

In hens the melting points of the abdominal and subcutaneous fats produced by a high protein ration were 34.2 and 32.2° C., but on a low protein diet they were 40.8 and 40°, respectively. Thus the fat produced by high protein diets contains more of the unsaturated fatty acids and a lower melting point than that produced by a lower protein diet. The effect of coconut oil, linseed oil, and hydrogenated cottonseed oil on the hardness of the fat of hens is also given.

Potassium in animal nutrition.—I, Influence of potassium on urinary sodium and chlorin excretion, H. G. MILLER (*Jour. Biol. Chem., 55 (1923), No. 1, pp. 45–59*).—This is the report of an experiment carried on at the Wisconsin Experiment Station to determine the effect of potassium feeding on the potassium, sodium, and chlorin excreted by pigs receiving starch, milk, or synthetic diets. An increase of the potassium salts in the diet caused an increase of the potassium, sodium, and chlorin excreted during the following 24 hours. The amount of sodium and chlorin excreted became normal in about 24 hours unless the feeding of potassium was continued, when the amount of sodium and chlorin secreted decreased even to less than the amount ingested.

[Feeding experiments with farm animals in Guam], C. W. EDWARDS (*Guam Sta. Rpt. 1921, pp. 2, 4, 5, pl. 1*).—Feeding tests with copra meal and tañgantañgan (*Leucaena glauca*) are reported.

Satisfactory results have been obtained in feeding copra cake and meal in combinations with corn, oats, rice bran, and wheat bran to dairy cattle. A ration of 3 parts of copra meal, 3 of rice bran, and 2 parts of cull dried Lima beans (cooked) was unsatisfactory for weanling pigs on a Para grass pasture.

Three gilts, however, made good gains from January 15 to May 1 on a grain ration of equal parts of copra meal, damaged rice (cooked), and cull dried Lima beans (cooked). Eight young sows and 2 boars were kept in good condition on a ration of copra meal and fresh cassava.

Feeding young sprouts or twigs of tañgantañgan bearing new growth to one Morgan stallion and a mare caused the hair in the mane and tail to fall out in from 12 to 30 days, but another mare tethered out in a pasture of tañgantañgan and grass and 2 Ayrshire bulls, 2 grade calves, and 2 grade kids fed on tañgantañgan showed no bad effects in trials lasting over 45 days. A rancher reported that 3 out of 10 pigs turned on a field containing much tañgantañgan had completely lost their hair in 4 months.

Beef cattle [feeding experiments at the Mississippi Station], E. BARNETT and S. W. GREENE (*Mississippi Sta. Rpt. 1922, pp. 14, 15, 53–57*).—The following experiments with beef cattle were carried on at the station and the Coastal Plain Substation.

Steer feeding experiment.—Three lots of 8 yearling steers each averaging about 980 lbs. were fed for 108 days on rations of 6.3 lbs. of cottonseed meal and 3.5 lbs. of hay, with the addition of 51.77 lbs. of corn silage, 55.3 of sorghum silage, and 57.23 lbs. of sunflower silage in the different lots. The average daily gains per head made by the lots were 2.07, 1.85, and 1.91 lbs., respectively. The rates of selling per 100 lbs. were $7.50, $7.25, and $7.10, and the average shrinkages in shipping to market were 2.1, 2.96, and 1.04 lbs., respectively, in the different lots.

Breeding herd.—The breeding herd, wintered on average daily rations of 35 lbs. of silage, 2 lbs. of cottonseed meal, and from 7 to 8 lbs. of hay increased in average weight during 73 days from 999.1 to 1,042.1 lbs. per head. To compare the advantages of marketing spring calves at the end of the first summer with the method of continuing them as yearlings to be marketed during the second winter, records were kept on the spring calves. During the winter period of 73 days the calves received 20.3 lbs. of silage, 3 lbs. of Johnson grass hay, and 4 lbs. of a grain mixture composed of equal parts of bran, corn, and cottonseed meal. The average weight at the beginning of the winter period was 437.3 lbs. and at the end of the period 538.7 lbs.

Steer feeding [at the Coastal Plain Substation].—To compare different forms of velvet beans with cottonseed meal, 3 lots of 10 steers each were fed for 98 days on sorghum silage with cottonseed meal in lot 1, dry velvet beans in the pod in lot 2, and velvet beans in the pod which had been soaked for 24 hours in lot 3. The respective gains per head in the different lots were 201, 197, and 174 lbs. The feed consumption per 100 lbs. gain was for lot 1, 280 lbs. of cottonseed meal and 2,460 lbs. of silage, lot 2, 560 lbs. of velvet beans and 1,832 lbs. of silage, and lot 3 645 lbs. of velvet beans and 2,065 lbs. of silage. The estimated costs of 100 lbs. of gain were, respectively, $11.90, $10.79, and $12.45, and the profits per head 35 cts., $3.15, and 73 cts. It is concluded that 2 lbs. of velvet beans will satisfactorily replace 1 lb. of cottonseed meal and a considerable amount of roughage, and where the cost is one-half that of cottonseed meal they are economical.

[Pasturing the breeding herd].—Thirty-seven cows and 12 calves were pastured from March 24 to November 2 on 500 acres of burned range pasture consisting mostly of sedge and wire grass, with some carpet grass and lespedeza. The cows made average gains of 107 lbs., and the calves of 229 lbs. during the period. Seven calves were born during the test. Of the 107 lbs. gain made by the cows, 87 lbs. of it were made before July 6. Yearlings on 1.6 acres per head of similar pasture gained 83 lbs. per head before July 6, but after the grasses

began to mature seed stems 10 acres per head were found to be insufficient to produce satisfactory gains.

[*Wintering the breeding herd*].—Thirty-six cows were wintered 140 days on 35 acres of stalk fields having scattered stands of velvet beans, followed by 42 days on carpet grass pasture with an additional feed of 5 lbs. of hay per day and by 56 days in dry lot receiving 1.5 lbs. of cottonseed meal, 22.5 lbs. of silage, and 4.5 lbs. of hay daily. Average gains of 20.8, —28.7, and —29.2 lbs., respectively, per cow were made by the different methods of feeding. Four calves suckling and 15 born during the winter made average gains per head of 92 lbs.

[*Pasturing the yearling herd*].—Twenty-five yearling steers and heifers were grazed for 112 days on 40 acres of range pasture followed by 154 days grazing on 40 acres of carpet grass. While on the range pasture they gained 0.74 lb. per day, but during the last 14 days of the period they lost weight. When first placed on the carpet grass average daily gains of 0.95 lb. were made, after which there was a reduction in the rate of gain. The average gain for the first 112 days on carpet grass was 0.7 lb. per day, but during the succeeding 42 days there was a loss of 15 lbs. per head.

[*Wintering the yearlings*].—The cost of wintering 31 calves and yearlings on home-grown feeds was determined. During the first 42 days they were on 40 acres of carpet grass and received an additional feed of 5 lbs. of mixed lespedeza and native and weed hay per head daily. The animals lost 20 lbs. per head during this period. The yearlings were then fed in dry lot for 56 days on an average daily ration of 3 lbs. of cottonseed meal, 15.2 lbs. of silage, and 5.7 lbs. of hay. There was a gain of 17.2 lbs. per head while fed in this way. The costs of feeding per head during the two periods were $1.26 and $5.16.

Cattle feeding [at the Wyoming Station], F. A. Hays (*Wyoming Sta. Rpt. 1922, p. 143*).—Four lots of 8 grade Hereford calves each made average daily gains per head of 0.4, 1.6, 0.50, and 0.63 lbs., respectively, on rations of native hay alone, alfalfa hay alone, native hay one-half feed and sunflower silage full feed, and native hay one-half feed and oat and pea silage full feed. The costs of the rations per 100 lbs. of gain were, in the respective lots, $12.89, $9.29, $9.73, and $9.81.

Cattle salting studies (*Kansas Sta. Bien. Rpt. 1921–22, pp. 11–14, fig. 1*).—To study the quantity and quality of salt consumed by cattle, two experiments have been carried on during the summer of 1921.

Forty-four steers were given access to several different kinds of salt consisting of block and loose salt made from evaporated and rock salt. The salt blocks were made under pressures from 400 to 700 tons. The following amounts of evaporated salt were consumed: 48.16 lbs. of 400-ton pressure block, 48.19 lbs. of 500-ton pressure block, 48.64 lbs. of 600-ton pressure blocks, and 40.47 lbs. of medium fine ground salt; and of the rock salt: 22.7 lbs. of 400-ton pressure block, 22.85 lbs. of 500-ton pressure block, 22.74 lbs. of 600-ton pressure block, 27.57 lbs. of 700-ton pressure block, and 92.52 lbs. of the crushed rock salt. It is concluded that the pressure under which the block salt is made does not influence the preference of the cattle for it, but rather that the kind of salt is the principal factor in determining the amount consumed.

The salt consumption of lots of steers receiving alfalfa hay and corn silage, respectively, in dry lot was determined during 1921–22. The average consumption per steer during the 150-day period was 15.59 lbs. in the alfalfa hay lot and 46.63 lbs. in the silage lot. Loose evaporated salt was used in this test. Chemical analyses showed the ash content of the alfalfa hay to be 7.63 and the corn silage 5.65 per cent. During the last month of the test the salt consumed

was more nearly equal in both lots, which may have been due to an increase of 5 per cent in the dry matter content of the corn silage and its low acidity.

Corrections were made for weathering in calculating the salt consumed in each of the experiments.

[Crossing Holsteins and Galloways at the Kodiak Station], W. T. WHITE (*Alaska Stas. Rpt. 1921, p. 46, pls. 3*).—To develop dual-purpose cattle suitable to Alaskan conditions 23 crosses between purebred Holsteins and Galloways have been made. Of the 8 F_1 females produced, 4 have calved and been milked through one lactation period. In milk production and conformation the heifers are promising. Only one F_2 calf has been dropped.

Brahma-Hereford cross (*Texas Sta. Rpt. 1921, pp. 8, 9*).—Calves sired by a three-quarter blood Brahma bull out of grade Hereford cows weighed from 30 to 40 lbs. per head more at 5 months of age than calves sired by pure bred Hereford bulls from similar cows.

Sheep-feeding investigations.—Wintering breeding ewes—ninety-day test, December 29 to March 30, A. E. DARLOW (*Oklahoma Sta. Bul. 142 (1922), pp. 8*).—In continuing the study of comparative winter rations for breeding ewes (E. S. R., 47, p. 71), 50 black-faced western ewes which had been run on pasture to December 20 were divided into 5 lots for a 90-day test, which is summarized in the following table:

Summary of experiments in wintering breeding ewes on different rations.

Lot.	Average initial weight	Average weight when lambing started at 65 days.	Average weight at 90 days.	Number of lambs born.	Average weight of lambs at birth.	Average weight of lambs at end of test.	Feed consumed per head daily.						Average cost of feed per head per day.
							Alfalfa hay.	Kafir corn.	Darso grain.	Darso silage.	Corn silage.	Sunflower silage.	
	Lbs.	*Lbs.*	*Lbs.*		*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Cts.*
1	134.3	149.8	130.6	11	7.3	14.5	3.663	0.85	.....	.....	.....	.....	2.47
2	134.1	145.2	137.3	13	10.5	15.5	3.663	.....	0.85	.....	.....	.....	2.47
3	133.9	155.0	143.8	8	9.7	18.0	1.666	.85	.....	4	.....	.....	2.475
4	133.7	153.3	129.7	15	8.7	15.4	1.666	.85	.....	.....	4	.....	2.475
5	134.6	142.4	136.3	4	9.5	12.2	1.666	.85	.....	.....	.....	4	2.475

The author concludes that sunflower silage is unsatisfactory, but ewes wintered on darso silage showed an advantage over those receiving corn silage. Alfalfa hay and whole kafir also proved satisfactory as a winter ration.

[Silage for feeding pregnant Gummer ewes], F. A. HAYS (*Wyoming Sta. Rpt. 1922, pp. 148, 149*).—Eighty old ewes were divided into four lots for a 121-day test and fed on sunflower silage and oat and pea silage, with and without the daily addition of ½ lb. grain (8 parts of bran and 2 parts of cottonseed meal). Neither of the silages were satisfactory when fed alone, but with the addition of grain sunflower silage gave fairly good results. The lamb crop and economy of feeding were greater in all cases with the sunflower silage.

Corriedale sheep for southwestern Texas (*Texas Sta. Rpt. 1921, p. 10*).—In a study of the adaptability of Corriedale sheep to southwestern Texas the lambs were found to make exceptional growth during the summer.

Sheep sheared twice a year have been found to produce about 1 lb. more wool per year than sheep sheared only once, and muttons sheared twice a year gained 2 lbs. per head more than those sheared only once. The fall

sheared ewes did not produce any more lambs than those sheared but once a year.

Effect of protein and mineral on the development of swine, C. P. THOMPSON (*Oklahoma Sta. Bul. 144 (1922), pp. 27, figs. 8*).—The results of experiments in feeding minerals to swine at the Kansas, Nebraska, Iowa, and Ohio Experiment Stations are briefly summarized, and it is generally indicated that additional minerals are not necessary in otherwise well-balanced rations. Two experiments carried on by the author are then reported.

The effect of protein and mineral supplement on development of the litter.—Three lots of 2 sows and 1 lot of 4 sows were selected for testing the effect of protein and mineral supplements on the development of unborn pigs. The rations fed were lot 1 kafir only; lot 2 50 parts of kafir, 20 parts of ground oats, 25 parts of wheat shorts, and 5 parts of tankage; lot 3 wheat shorts and kafir equal parts; and lot 4 same as lot 3 with the addition of 1 per cent of a mineral mixture of calcium carbonate and precipitated bone meal. The average numbers of pigs farrowed per litter in the different lots were 5, 9, 11, and 8, and their respective average weights were 1.94, 2.94, 2.12, and 2.25 lbs. Eighty-one per cent of the pigs in lots 2 and 4 were classed as strong and 54 per cent in lot 3, but none of the pigs in lot 1 were strong though 80 per cent were classed as medium. The ash in the bone of the pigs at birth was peculiar in that it constituted 48.14 per cent in the pigs of lot 1, 43.2 per cent in lot 2, 47.13 per cent in lot 3, and 43.33 per cent in the bones of the pigs of lot 4. The rate of growth up to 30 days of age was most rapid in the pigs of lot 2, followed closely by lots 4 and 3, with lot 1 showing the poorest growth. The milk production of the sows is thought to be responsible for the rate of growth, and an analysis of the growth indicated that the ash content seemed to be influenced by the protein of the ration. The average ash content of the milk in the different lots was as follows: Lot 1 0.513 per cent, lot 2 0.862, lot 3 0.797, and lot 4 0.757 per cent.

The effect of protein and mineral on the development of swine.—To test the effect of protein and mineral supplements on the growth and development of swine receiving carbonaceous rations, 25 shotes were divided and placed on the following rations: Lot 1 kafir only, lot 2 kafir and 1 per cent of minerals (calcium carbonate and precipitated bone meal), lot 3 equal parts of kafir and wheat shorts, lot 4 9 parts of kafir and 1 part of tankage, and lot 5 equal parts of kafir and wheat shorts with 1 per cent of minerals. The results of the test are summarized in the table below, showing the gains in weight, body measurements and composition, and strength of the bones:

The effect of protein and mineral supplements on growth and development of swine.

Lot.	Average initial weight.	Average gain.						Average breaking strength of bone.	Ash in bones.
		Weight.	Body length.	Depth of chest.	Width of chest.	Circumference of bone	Length of leg.		
	Lbs.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Lbs.*	*Per cent.*
1	86.6	48.9	38.9	15.4	22.7	17.9	22.9	152.0	56.62
2	79.9	43.4	33.0	18.3	16.6	10.5	21.4	204.0	60.61
3	89.0	105.6	50.0	30.0	27.7	10.0	21.4	180.0	54.81
4	99.4	139.5	55.6	44.56	41.5	25.4	30.45	287.0	57.19
5	88.6	97.0	49.5	37.0	37.5	32.0	26.85	296.5	55.08

The results of this test tend to emphasize the importance of the proper amount of protein for maximum growth and development and minimize the necessity of adding minerals to a properly balanced ration, especially when such proteins as tankage are used, which in itself is high in mineral content.

The effect of ration on the cost and rate of gain in swine.—Using the results of the above experiment, the author has calculated the cost per 100 lbs. of gain in the lots 1 to 5, respectively, as $8.86, $10.17, $5.53, $5.72, and $6.41. From these results he concludes that the addition of minerals increased the cost of gain and the amount of feed required to produce 100 lbs. of gain, but decreased the rate of gain and the total profits. Protein supplements added to a carbonaceous ration increased the rate of gain but decreased the amount of feed required and the cost of gains. The author, however, states that the addition of a small percentage of mineral matter to a ration containing a protein supplement low in minerals will produce stronger bone with a very much higher breaking strength.

[Hog feeding experiments at the Mississippi Station], E. Barnett (*Mississippi Sta. Rpt. 1922, pp. 15, 16*).—In soft pork studies in cooperation with the Bureau of Animal Industry, U. S. D. A., 51 hogs were grazed for 43 days on soy beans and then finished for 28 and 56 days on corn and tankage. Fifteen hogs were also grazed for 43 days on peanuts, followed by a finishing period of 28 days on corn and tankage and 28 days on 1 part of cottonseed meal and 2 parts of corn. The results of the slaughter tests indicated that the soft carcasses of the peanut-fed hogs could not be hardened on the corn and tankage and corn and cottonseed meal in the time allotted, though the finishing period seemed to produce some improvement in the carcasses of those fed soy beans.

An experiment in which lots of fall pigs were self-fed for 47 days on corn and tankage and rice polish and tankage indicated less difference in the efficiency of corn and rice polish, as the average daily gains were 1.99 and 1.95 lbs., respectively. Both lots were equally well finished, and dressing percentages were within 0.79 per cent of each other.

[Hog feeding tests with milo chop supplemented with cottonseed, cottonseed meal, and tankage] (*Texas Sta. Rpt. 1921, p. 9*).—To compare the relative feeding values of cottonseed meal, cottonseed, and tankage, three lots of 10 Duroc-Jersey pigs averaging about 65 lbs. were fed for 120 days on milo chop with the above supplements in the different lots. The cottonseed proved so unpalatable that cottonseed meal and tankage were substituted. The tankage lot was the only one showing a profit over feed and selling expenses. One hog died of poisoning from the lot receiving cottonseed meal. Records of the minerals consumed by the different lots were kept during the test, and it is noted that the lot receiving tankage consumed less minerals than the others.

In another test lots of Duroc-Jersey sows and pigs were fed on milo chop in dry lot in one case and on pasture in another, and a third and fourth lot received a mixture of 9 parts of milo chop and 1 part of tankage in dry lot on Sudan grass and oat pasture, respectively. The lot receiving milo chop and tankage while on pasture made a profit of $15.62, as compared with $5.63 for the lot receiving the same ration in dry lot, a loss of $6.21 for the lot receiving milo alone on pasture, and a loss of $6.37 for the lot receiving milo alone in dry lot.

Supplements for swine feeding, W. E. J. Edwards (*Michigan Sta. Quart. Bul., 5 (1923), No. 4, pp. 157, 158*).—The use of skim milk, buttermilk, tankage, wheat middlings, fish meal, linseed meal, clover, or alfalfa is recommended along with corn to supply sufficient protein and minerals in hog rations.

Sweet potatoes produce pork, E. H. HOSTETLER (*Breeder's Gaz., 83 (1923), No. 19, p. 646*).—At the Edgecombe, N. C., Substation 2 lots of pigs were fed for 43 days on cull sweet potatoes and fish meal in self-feeders. In addition to this feed lot 2 received 2 lbs. of shelled corn per 100 lbs. of live weight per day. The results of the two lots in the test were, respectively, average initial weight 66 and 64.5 lbs., average daily gain 1.14 and 1.05 lbs., feed consumed per 100 lbs. gain, corn 23 and 162 lbs., potatoes 1,039 and 834 lbs., and fish meal 61 and 62 lbs. Lot 1 scoured at two different times during the test, and corn was fed to correct this condition. The quality of the pork in both cases was good.

[Garbage for fattening pigs], F. A. HAYS (*Wyoming Sta. Rpt. 1922, p. 149*).—Two trials in feeding garbage to pigs have been carried on. Three lots of pigs were fed in each case on rations of garbage alone, garbage one-half feed and whole barley hand-fed 1 per cent, and whole barley alone self-fed. The gains made during the 57-day feeding period were greatest with garbage alone, next with garbage and barley, and poorest with the barley alone. The feed costs per 100 lbs. of gain were greatest with the garbage and least with the garbage and barley. The feeding value of garbage alone was calculated at $14.58 per ton in the first test and $12.60 in the second test. When fed in combination with barley or other carbonaceous feeds its feeding value is increased.

Pigs and bacon curing, R. E. DAVIES (*London: Crosby Lockwood & Son, 1923, pp. XII+86, pls. 7, figs. 4*).—This is a manual describing the English methods of curing hams, bacon, and other pork products, with notes on the best breeds of bacon hogs. Methods of feeding, killing and cutting pork and estimating the age and weight of live pigs are discussed.

[Poultry experiments at the Oklahoma Station] (*Oklahoma Sta. Rpt. 1922, pp. 23, 24*).—By mating a male White Leghorn from a 280-egg dam with a high-producing female, 70 pullets were raised, of which 25 per cent laid over 200 eggs per year, averaging 216 eggs, and 77 per cent averaged 190 eggs in 12 months.

Artificial illumination from 4 a. m. in the morning with none in the evening increased the winter egg production 73 per cent in White Leghorns and 37 per cent in the medium-weight breeds.

After six times handling and observing 300 birds of 8 breeds it has been possible to suggest the desirable characteristics of most good producers in August and September for use in culling the flock.

The influence of ration on production and hatchability of eggs (*Kansas Sta. Bien. Rpt. 1921–22, pp. 22–24*).—In studying the effect of inadequate rations on the production and hatchability of eggs, 4 pens of hens were fed adequate rations supplemented in some cases with succulent feed while 4 other pens were fed rations that were chemically adequate or inadequate. The individuality of the birds seemed to be a big factor in determining the results, as the eggs from some hens receiving inadequate rations hatched well while eggs from other hens receiving adequate rations failed to hatch.

Comparison of cottonseed meal with animal protein feeds for laying hens (*Texas Sta. Rpt. 1921, p. 12*).—Four lots of hens receiving cottonseed meal and tankage in varying proportions from 19 lbs. of cottonseed meal with 85 lbs. of tankage to 63 lbs. of cottonseed meal with 50 lbs. of tankage showed that the higher the cottonseed meal content the cheaper per pound was the ration, but the amount required to produce 1 doz. eggs was likewise greater.

Rhode Island Reds crossed with native white hens, C. W. Edwards (*Guam Sta. Rpt. 1921, pp. 6, 7*).—The F_1s from a cross between Rhode Island Reds and native hens were larger and produced larger eggs than the native parents. The birds were mostly red in color, but the eggs varied from white to brown.

Normal temperature of adult fowl, B. F. Kaupp (*Poultry Item, 25 (1923), No. 7, pp. 12, 13*).—Temperatures of a number of fowls, taken at the North Carolina Experiment Station during 1918 to 1920 and during one season at the Manitoba Agricultural College by Herner, indicate that the average annual temperature of normal fowls is approximately 107.3° F. This temperature, however, is slightly higher during warm and lower during cold weather. Temperatures as high as 110.5° were recorded for normal birds when the atmospheric temperature was 94°.

Methods of preserving eggs, D. B. Swingle and G. E. Pool (*Montana Sta. Circ. 111 (1923), pp. 8*).—The results of a series of tests of different preservatives for eggs are briefly reported.

Water glass in the strength of 1:25 was found to be the most satisfactory for home use. Various forms of grease and patented preservatives maintained the quality of the eggs for 4 or 5 months, but they were more expensive and not as certain or lasting as the water glass.

Silver fox farming, F. G. Ashbrook (*U. S. Dept. Agr. Bul. 1151 (1923), pp. 60, pls. 4, figs. 46*).—This is a general description of the history and common practices employed in fox farming. Directions are given for constructing and equipping a ranch and for feeding, breeding, and general management of the fox farm. The methods of preventing diseases and parasitic infestations are also discussed.

DAIRY FARMING—DAIRYING.

[Experiments with dairy cattle at the Mississippi Station], J. S. Moore (*Mississippi Sta. Rpt. 1922, pp. 23–25*).—The report of the dairy department includes the results of two experiments.

Relative value of cottonseed meal and velvet beans.—In testing the comparative values of cottonseed meal and velvet beans for milk production 20 cows received the same rations for a 3 weeks' preliminary period, followed by two 6 weeks' test periods, with 1 week transition period between. The cows were divided into 4 lots for the test periods, all lots receiving a basal ration of 7 lbs. of Johnson grass hay, 30 lbs. of corn silage, 5 lbs. of corn and cob meal, 1.4 lbs. of cottonseed meal, 2 lbs. of wheat bran, and 1.4 lbs. of wheat shorts, with the addition during the first test period in lot 1 of 2 lbs. of cottonseed meal; lot 2, 3 lbs. of velvet bean and pod meal; lot 3, 3 lbs. of soaked velvet beans and pods; and lot 4, 1 lb. of cottonseed meal and 1.5 lbs. of velvet bean and pod meal; and during the second test period lot 1, 1 lb. of cottonseed meal and 1.5 lbs. of velvet bean and pod meal; lot 2, 2 lbs. of cottonseed meal; lot 3, 3 lbs. of velvet bean and pod meal; and lot 4, 3 lbs. of soaked velvet beans and pods.

The average weekly changes in milk production were, for the first and second test periods, respectively, lot 1, −158.8 and +112.7 lbs.; lot 2, −108.9 and +68.7 lbs.; lot 3, −140.7 and +115.3 lbs; and lot 4, −14.11 and +75.6 lbs.; and the changes in live weight for each period were lot 1, −21 and +31 lbs.; lot 2, −27 and +29 lbs.; lot 3, −29 and +18 lbs.; and lot 4, −1 and +25 lbs.

The author states that 3 lbs. of velvet bean and pod meal were better than 2 lbs. of cottonseed meal or 1 lb. of cottonseed meal and 1.5 lbs. of velvet bean and pod meal. Three lbs. of soaked velvet beans and pods were not quite equal to 1.5 lbs. of velvet bean and pod meal and 1 lb. of cottonseed meal, but were better than 2 lbs. of cottonseed meal.

Early fall calving v. late fall calving.—The average production of cows calving in the early fall was 7,295 lbs. of milk and 335.9 lbs. of fat, as compared with 7,880 lbs. of milk and 364.9 lbs. of fat produced by cows calving in the late fall. Similar results were obtained in the three previous experiments except that the average production was lower.

Sudan grass as a pasture for dairy cattle (*Kansas Sta. Bien. Rpt. 1921–22, pp. 34, 35*).—Results of pasturing Sudan grass at the Colby Substation are reported. Two cows pastured a field of 1.7 acres from July 16 to October 22, which had been plowed in April and sown with Sudan grass at the rate of 25 lbs. of seed per acre on June 15. The cows received 1 lb. of grain for each 4 lbs. of milk produced during the period. They gained slightly in weight while on the Sudan pasture and produced 5,005 lbs. of milk. This demonstrates the high-carrying capacity of Sudan grass pasture and its excellent value for milk production.

Silage feeding investigations for milk production, S. I. Bechdel (*Pennsylvania Sta. Bul. 178 (1923), pp. 3–23*).—Three experiments which have been peviously noted (E. S. R., 47, p. 478; 49, p. 274) are more fully reported.

The plans of all the experiments were similar in that 2 lots of cows were selected and the time allotted to each test was divided in half so that each lot of cows received each ration. The methods of feeding were also similar in each case. In calculating the results, data on the first week's feeding of each ration were not included.

Corn-soy bean silage compared with corn silage for milk production.—Two feeding trials of 8 and 12 weeks' duration were carried on with 16 and 12 cows, respectively, to compare the milk-producing value of corn silage and silage composed of 30 per cent of soy beans and 70 per cent of corn. About 32.5 lbs. of the silage was fed per 1,000 lbs. live weight daily. In addition to the silage, each cow received daily about 8 lbs. of mixed clover and timothy hay per 1,000 lbs. live weight in the first trial and 6 lbs. of red clover hay containing a little timothy in the second trial and 1 lb. of grain to each 3.5 to 3.75 lbs. of milk produced. The grain mixture consisted of 200 lbs. of corn meal, 150 lbs. of ground oats, 200 lbs. of ground barley, 75 lbs. of dried distillers' grains, 200 lbs. of cottonseed meal, 100 lbs. of linseed meal, and 7 lbs. of salt. The table below gives the average results of each trial designated as experiments 1 and 2. The corn-soy bean silage apparently had a slightly higher feeding value for milk production than corn silage, but the cost of the soy beans was greater.

Oat and pea silage for milk production.—In one trial of 6 weeks' duration using 16 cows, Canada field pea and oat silage was compared with corn silage; and in another trial of 8 weeks' duration using 12 cows, oat and pea silage was compared with no silage. The grain mixtures used when corn silage was compared with the oat and pea silage consisted of 150 lbs. of oats, 50 lbs. of barley, 50 lbs. of corn meal, 50 lbs. of peanut meal, 100 lbs. of wheat bran, and 200 lbs. of cottonseed meal. A somewhat similar mixture was used in the second trial. The results of these tests are summarized in the table below as experiments 3 and 4.

Oat and pea silage was inferior to corn silage for milk production, but the live weights of the animals seemed to be maintained better. Where no corn silage is available, oat and pea silage substituted for part of the hay should decidedly improve the milk-producing value of the ration. Oat and pea silage is especially recommended for summer feeding when neither corn silage nor good pasture is available.

Composition and feeding value of red clover silage.—In an 8 weeks' test, 12 cows were employed in comparing rations containing clover silage with rations

containing no silage for milk production. The grain mixture fed was similar in composition to those which the cows received in the two preceding tests. A summary of the results of this test is given in the table below as experiment 5. The ration including the clover silage was decidedly better for milk production than the ration containing no silage.

Summary of the silage-feeding experiments for milk production.

Experiment.	Group.	Kind of silage.	Weeks averaged.	Feed consumed.			Average gain in live weight.	Production.	
				Grain.	Hay.	Silage.		Milk.	Fat.
				Lbs.	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*
1	1	Corn	2d to 4th	1,290.8	1,295.7	5,927.6	4	4,792.6	193.92
1	1	Corn and soy bean	6th to 8th	1,216.6	1,312.5	6,132.0	−10	4,584.4	183.07
1	2	do	2d to 4th	1,177.4	1,323.0	6,076.0	5	4,463.3	188.67
1	2	Corn	6th to 8th	1,124.2	1,323.0	6,235.6	11	4,286.8	164.48
2	1	do	2d to 6th	1,761.6	1,417.5	7,516.0	−50	6,104.7	228.94
2	1	Corn and soy bean	8th to 12th	1,526.4	1,359.9	7,540.7	−41	5,373.5	197.98
2	2	do	2d to 6th	1,869.0	1,414.1	7,229.6	7	6,574.3	262.01
2	2	Corn	8th to 12th	1,530.6	1,359.9	7,883.9	9	5,504.3	198.09
3	1	do	2d to 3d	750.4	831.6	3,794.0	0	2,697.6	100.83
3	1	Oat and pea	5th to 6th	663.6	819.3	4,008.9	11	2,204.0	81.33
3	2	do	2d to 3d	705.6	826.0	4,022.0	32	2,333.9	94.03
3	2	Corn	5th to 6th	649.6	826.0	4,021.5	−43	2,304.6	90.76
4	1	None	2d to 4th	586.5	1,977.0	.....	−12	1,836.4	88.17
4	1	Oat and pea	6th to 8th	494.4	722.0	4,461.2	9	1,691.6	81.95
4	2	do	2d to 4th	654.5	819.0	3,863.3	4	2,056.5	90.80
4	2	None	6th to 8th	542.6	1,955.1	.....	−23	1,484.8	78.17
5	1	Clover	2d to 4th	751.2	1,096.7	4,313.5	−25	2,567.7	107.16
5	1	None	6th to 8th	651.0	2,339.4	.....	−13	2,111.0	81.29
5	2	do	2d to 4th	799.4	2,423.4	.....	−7	2,778.8	122.92
5	2	Clover	6th to 8th	775.6	1,050.6	3,834.2	13	2,691.6	118.18

Powdered skim milk for calf feeding, C. H. Eckles and T. W. Gullickson (*Hoard's Dairyman, 65 (1923), No. 5, pp. 154, 166, figs. 4*).—The results of experiments in feeding calves on powdered skim milk at the Minnesota Experiment Station are briefly reported. Calves receiving alternate feeds of powdered and fresh skim milk showed no bad effects from the changes. Later, 1 Jersey, 1 Guernsey, and 3 Holstein calves were fed whole milk until 10 days or 2 weeks of age, followed by skim milk made by dissolving 1 lb. of skim milk powder in 9 lbs. of water. Grain and hay were fed at all times, so that at 63 days of age the amount of skim milk was gradually reduced and stopped at 74 days.

The 3 Holsteins required an average of 148 lbs. of whole milk, 71 lbs. of skim milk powder, 41 lbs. of grain, and 49 lbs. of alfalfa hay to reach this age. These calves were all below normal weight at weaning time and at 6 months of age, but by 8 months of age those that were kept were above normal weight.

In another test 3 grade Holstein heifer calves were fed a low grade of malted milk in place of the powdered skim milk but in the same proportion. These calves were weaned at 50 days of age with very satisfactory results.

Four methods of developing dairy heifers (*Kansas Sta. Bien. Rpt. 1921–22, p. 19*).—Four different methods of feeding and breeding dairy heifers have been compared, and 19 heifers have been carried through their first lactation period and 17 through the second lactation. The rations used consisted for lot 1 of alfalfa hay alone, lot 2 alfalfa hay and corn silage, and lots 3 and 4 alfalfa hay, corn silage, and grain. The heifers in lots 1 to 3 were bred to calve at 30 months of age, and in lot 4 at 24 months. The costs to bring a heifer to 2 years of age in lots 1 to 4 were, respectively, $62.43, $60.74, $82.31, and $82.90. The respective average weights of the heifers in the different lots were 766 lbs., 802, 1,014, and 1,057 lbs. The feed cost during the first lactation period was also lowest in the lot receiving alfalfa and silage. The least profit accrued

in the alfalfa lot. In the second lactation period the feed cost of the lot receiving alfalfa hay alone was the lowest.

The variation and inheritance of milk characters, T. ELLINGER (*Natl. Acad. Sci. Proc., 9 (1923), No. 4, pp. 111–116*).—The results of a genetic study of 14 years' records on Jersey and Red Danish cattle and hybrids between the two from the herd of F. Ahlefeldt-Laurvig at Tranekjaer Castle, Denmark, are briefly reported.

The following are some of the constants which were determined for the Red Danish and Jersey cattle, respectively: Time between calvings 54.69±0.37 and 53.96±0.5 weeks; milk production in the first 10 weeks of lactation 790.35±7.04 and 638.94±8.68 kg., second 10 weeks 677.56±6.19 and 502.88±7.27 kg., third 10 weeks 555.93±5.77 and 409.62±6.24 kg., and fourth 10 weeks 382.91±6.44 and 277.4±7.16 kg.; correlation of time between calving and breeding with milk production during the first 10 weeks of lactation 0.072±0.046 and 0.086±0.066, during the second 10 weeks 0.124±0.045 and 0.155±0.065, during the third 10 weeks 0.234±0.044 and 0.253±0.062, and milk production during the fourth 10 weeks 0.551±0.032 and 0.553±0.046.

It was determined that the time and age of calving and lactation period affected the production. The production of the second to the eleventh week was least influenced by the time of breeding and was, therefore, the most reliable indication of the cow's productive capacity.

All records have been corrected for purebreds and crosses on the basis of the first lactation period for cows calving between 28 and 35 months of age in March and for the second to the eleventh week of lactation. With these corrections the following constants were determined:

Corrected constants for milk production for the second to eleventh week of the first lactation period.

Breeding.	Milk production.	Fat percentage.	Correlation between amount of milk and fat percentage.	Butter fat production.
	Kilograms.	*Per cent.*		*Kilograms.*
Red Danish	895.7±11.3	3.56±0.01	+0.055±0.044	32.12±0.57
Jersey	711.5±13.8	4.94± .03	−0.332± .051	36.54± .99
Crossbred	832.4±18.6	4.21± .03	−0.246± .073	35.72± .78
¾ Danish	880.6±36.9	4.04± .05	−0.011± .148	34.00±1.85
½ Jersey	742.3±18.6	4.53± .04	−0.149± .078	36.16± .88
⅞ Jersey	700.0±23.4	4.60± .06	−0.282± .134	31.55±1.08

The author concludes from the data that the method of inheritance of milk characters is complex and fails to disclose the action of any single Mendelian factor.

A zootechnical study of the cattle and cattle production on the Madeira Islands, J. KOK (*Het Rund en de Rundveeteelt op Madoera. Een Zoötechnische Studie. Proefschr., Veeartsenijk. Hoogesch., Utrecht, 1921, pp. [4]+187, figs. 4*).—This is a complete description of the cattle and cattle production of the Madeira Islands.

Guide to dairying in South Africa, R. B. COOK (*Cape Town: T. Maskew Miller, [1922], pp. VIII+202, pls. 16, figs. 13*).—The practical phases of dairying are taken up with special reference to South African conditions. The feeding, breeding, management, and breeds of dairy cattle are described, as well as the care, sanitation, and chemistry of milk. A chapter by E. O. Challis on why cream tests vary is also included.

Minutes of evidence taken before the interdepartmental committee appointed by the president of the Scottish Board of Health to inquire and report on the laws, regulations, and procedure governing the sale of milk in Scotland (with appendixes) (*Edinburgh: Govt., 1922, pp. 323*).—This consists mainly of testimony presented in a 16-day conference on the laws, regulations, and procedure governing the sale of milk in Scotland.

Improvement of the conditions of collection, preparation, and transportation of milk, M. Poher (*Rev. Gén. Froid et Indus. Frigor., 2 (1921), No. 10, pp. 343–350, figs. 3*).—The more modern methods of handling and caring for milk used in supplying the larger cities are discussed, with special reference to the milk supply of Paris. The necessity of pasteurization and proper refrigeration is becoming more evident as the milk has to be transported longer distances and kept for longer times before distribution. Descriptions are given of the methods of refrigerating cars and other means of transportation, and a refrigerating plant for a commercial dairy is diagramed.

Milk.—An interim report of the New South Wales Board of Trade upon the conditions of production and distribution of certain commodities (*Sidney: Govt., 1923, pp. XIV+211*).—This contains information on the milk production of New South Wales, dealing with the quantity of milk produced, the cost of production and distribution, and the regulations for maintaining quality.

The influence of unsterile utensils on clean milk, E. C. V. Mattick and H. S. Hallett (*Milk Indus., 3 (1923), No. 8, pp. 39, 41, 42, figs. 3*).—The results of an experiment in which milk was contaminated by unsterilized utensils are reported from the National Institute for Research in Dairying.

In this test a sample of milk containing 70 bacteria per cubic centimeter was put into a clean, dry vat which had not been sterilized, after which it was pasteurized and found to contain 26,000 bacteria per cubic centimeter. In another test the vat was sterilized, and the bacterial content of milk receiving the same treatment was reduced from 220 to 10 bacteria per cubic centimeter.

[Experiments in dairying at the Oklahoma Station] (*Oklahoma Sta. Rpt. 1922, pp. 16, 17*).—Butter made from first grade cream sold for 3 cts. more per pound on the Chicago market than butter made from second grade cream. Pasteurizing cream was found to improve the flavor of butter made from it, and the butter also stood up better on the market.

By making bacterial counts before pasteurizing and after pasteurizing and bottling, it was determined that pasteurizing milk in the bottle was from 20 to 30 per cent more efficient than pasteurizing in a vat and bottling afterwards.

Why do cream tests vary? H. B. Ellenberger (*Cream. and Milk Plant Mo., 12 (1923), No. 7, pp. 84, 78*).—In experiments at the Vermont Experiment Station it was found that the following factors tend to influence the fat content of separated cream: Low temperature of the milk, high speed of the separator, rich milk, use of a small amount of milk in flushing the bowl, or reduced rate of flow of the milk into the separator. An unclean or unbalanced bowl may cause considerable variation in the cream test and may result in greater losses of fat in the skim milk.

The clarification of milk for cheese making, W. W. Fisk and W. V. Price (*New York Cornell Sta. Bul. 418 (1923), pp. 3–14, figs. 7*).—To determine whether clarifying milk improves the cheese made from it, samples of milk were taken at the New York Cornell Station, the Massachusetts Station, and two commercial cheese factories, divided into two portions, and made into

cheese, one portion being clarified before making the cheese. The quality of the cheese made from each portion was then determined.

It was found that cheese made from clarified milk was less likely to be gassy, and in all comparative tests it had a slightly better score than cheese made from a like sample of unclarified milk. The average total score of the samples of clarified-milk cheese was 93.773, and for unclarified-milk cheese 91.908. Differences in score were largely due to flavor and body and texture, the average scores for flavor being for the clarified milk cheese 44.948 and 43.666 for the cheese made from unclarified milk. The respective scores for body and texture were 23.858 and 23.185. The results of clarification were uniform from milk of good and poor quality and when commercial starter was or was not used. The loss of fat in the whey also appeared to be reduced by clarification of the milk.

VETERINARY MEDICINE.

Report of the pathologist, I. E. NEWSOM (*Colorado Sta. Rpt. 1922, pp. 25, 26*).—The work conducted has seemed to indicate that a higher degree of immunity to hemorrhagic septicemia could be obtained in sheep by the use of a vaccine from a live organism. Two additional outbreaks of ictero hematuria, which seems to occur in September, October, and November, were studied during the year, but nothing definite was determined as to the cause. Agglutination tests of blood from a considerable number of range animals in the mountainous district indicated that a considerable proportion of abortion in these herds may be due to some factor other than *Bacterium abortus* Bang.

[Chemical examinations of stock-poisoning plants in Wyoming], O. A. BEATH (*Wyoming Sta. Rpt. 1922, pp. 151–155*).—Several stock-poisoning plants studied by the author are briefly reported upon, namely, *Delphinium menziesii*, *Lupinus argenteus*, *Aconitum columbianum*, *D. bicolor*, *D. cucullatum*, *Arenaria hookeri*, and *Parmelia molliuscula*.

A study on the toxicity of carbon tetrachlorid, J. R. MEYER and S. B. PESSÔA (*Amer. Jour. Trop. Med., 3 (1923), No. 3, pp. 177–196, figs. 3*).—Studies conducted by the authors have led to the following conclusions:

"Carbon tetrachlorid is a substance which exerts a toxic action on the animal organism (dogs) when administered by mouth. The most marked lesions are observed both by macroscopic and by microscopic examination in the liver and in the kidneys. The severity of these lesions seems to vary in inverse ratio to the age of the animal. The severity of the liver necrosis is in direct proportion to the dose administered, although we occasionally observed a case of hypersusceptibility to carbon tetrachlorid. The liver necrosis appears to be brought about by the same mechanism as that from chloroform intoxication. The renal lesions are less severe than those in the liver and develop more slowly. Both liver and kidneys show active power of regeneration to replace the destroyed parenchyma.

"Carbon tetrachlorid is a powerful vermifuge. When administered in doses of 0.3 cc. per kilogram of body weight it removed all ancylostomes in dogs. The administration of this vermifuge should be undertaken with caution in the treatment of human beings, and the doses recommended by Hall [E. S. R., 46, p. 282] may be too large."

The effect of carbon tetrachlorid on intestinal protozoa, M. J. HOGUE and C. VAN WINKLE (*Amer. Jour. Trop. Med., 3 (1923), No. 3, pp. 197–202*).—The author finds that carbon tetrachlorid in doses of 1 cc. is not specific for the

treatment of infections of Giardia and spirochetes in kittens, and that in 3 cc. doses it is not a specific for the treatment of human infections of *G. intestinalis, Trichomonas hominis, Chilomastix mesnili, Endolimax nana,* and *Iodamoeba williamsi.*

Infectious abortion in domestic animals, I, H. M. WEETER (*Jour. Infect. Diseases, 32 (1923), No. 6, pp. 401–416*).—In this first contribution, from the department of hygiene and bacteriology of the University of Chicago, the author deals with infection of swine and rabbits.

"Organisms culturally and seriologically identical with *Bacterium abortum* (Bang) were isolated three times in 389 nongravid swine uteri examined microscopically, of which number cultures were made in 259. This organism was isolated once from a macerated fetus and associated membranes in an examination of 289 gravid swine uteri, of which number cultures were made in 181. The agglutination reactions of the blood serum of 435 sows slaughtered at abattoirs were positive in a dilution of 1:50 in 14.7 per cent of the specimens and in a 1:100 dilution in 9 per cent of the specimens. Of 190 specimens of barrow's blood, 10 or 5.3 per cent were positive in a 1:50 dilution and 5 or 2.6 per cent in a 1:100 dilution.

"Feeding of suspensions of *B. abortum* to a pregnant sow on the forty-eighth day of gestation resulted in the production of agglutinins but not in abortion. Five healthy pigs and one macerated fetus were farrowed at the termination of the normal gestation period. *B. abortum* was not isolated from the fetal membranes, macerated fetus, or from the stomach contents and organs of the healthy pigs. The agglutination reaction of the dam declined at or shortly before farrowing and was not increased by further feeding of the organism to the nonpregnant animal. Elimination of the initial infection and of subsequently ingested organisms was indicated by failure to recover *B. abortum* from the liver, ovaries, spleen, mesenteric lymph glands, kidneys, intrauterine surface, lactating and nonlactating mammary glands 6 months after the feeding of the last culture.

"Two gilts, one fed cultures of *B. abortum* over a period of 4 months, beginning at 2.5 months of age, and one fed cultures for 32 days beginning at 4.5 months of age, gave slight and inconclusive increases in their agglutination reactions at 6.5 months. At 9 months, the reactions were the same as those given by the animals before they were fed the organisms. A boar fed cultures of the organism for 32 days beginning at 4.5 months showed no change in the agglutinating power of its blood serum up to 9 months of age.

"In experiments on the avenue of infection of rabbits by *B. abortum* as determined by the agglutination test, it was found that agglutinins developed readily in male and female rabbits as a result of ingestion of *B. abortum.* With one exception, agglutinins did not develop as a result of frequent implantation of the organism in the genital tract."

The study of the effect of culture media upon the Bacillus abortus and the use of biologics in the production of immunity (*Oklahoma Sta. Rpt. 1922, p. 25*).—In this brief progress report it is noted that the rate of growth of *B. abortus* in suitable culture media depends upon the H-ion concentration of the media. In tests of media of H-ion concentrations of pH 6.8, 7.4, 7.8 and 8, the maximum growth was obtained at pH 7.4. It is also stated that polyvalent bacterins have been successful in some cases in controlling the disease, the success apparently depending upon the condition of the heart previous to vaccination, the time of vaccination, and the general condition of the breeding animals at the next time of parturition.

[Report of the Kansas] department of veterinary medicine (*Kansas Sta. Bien. Rpt. 1921–22, pp. 25, 26*).—This consists of a report of a study of the

behavior of *Bacterium abortus* and an attempt to induce artificial immunity in cattle. The work of the previous year in the correlation of lesions of other organisms with those of *B. abortus* was repeated. "The number of abortion organisms isolated is small as compared with the number or organisms other than *B. abortus* coming from fetuses which have been aborted and from cows with retained afterbirth. . . . Out of the 80 cases there were obtained but 14 cultures of *B. abortus*, or 17.5 per cent, as against 57.5 per cent of organisms other than *B. abortus*. Twenty-five per cent of the cases were sterile bacteriologically. These results seem to suggest that *B. abortus* is not the sole incitant of abortion disease."

Control of bovine infectious abortion, I. F. HUDDLESON (*Michigan Sta. Quart. Bul., 5 (1923), No. 4, pp. 178–182*).—Directions are given which if followed will, according to the author, control abortion in the infected herd and prevent infectious abortion from entering a clean herd.

Duration of passive immunity, A. T. GLENNY and B. E. HOPKINS (*Jour. Hyg. [London], 21 (1922), No. 2, pp. 142–148, figs. 2*).—This paper deals with the rate of disappearance of diphtheria antitoxin in normal rabbits and also in rabbits sensitized by small doses of serum such as are present in 1 cc. of toxin-antitoxin mixtures intended for human immunization.

In the former case the course of disappearance of the passive immunity thus induced was found to consist of three phases as follows: (1) A phase of initial loss occurring within the first 24 hours, during which time one-half of the entire amount of antitoxin present 15 minutes after the injection is lost; (2) a phase of gradual constant percentage loss lasting from 6 to 7 days, during which time a quarter of the total antitoxin present each day is lost by the next day; and (3) a phase of accelerated loss during which from one-half to three-fourths of the total antitoxin present each day is lost by the next day. In rabbits sensitized with small doses of horse serum three phases are also seen, but the second phase lasts only 2 or 3 days, while in the third phase over 90 per cent of the antitoxin present is lost within 24 hours. It is suggested that the first loss is due either to precipitin to horse serum normally present in rabbits, or to saturation of the tissues, and that the third phase is due to the formation of precipitin commencing 7 or 8 days after the injection of horse serum in normal rabbits and 3 or 4 days after injection in sensitized rabbits.

Preliminary report on the differentiation of various organisms belonging to the hemorrhagic septicemia group, C. P. FITCH and E. N. NELSON (*Jour. Amer. Vet. Med. Assoc., 63 (1923), No. 2, pp. 147–161*).—The authors here present tables which show the action of 28 strains of organisms belonging to the hemorrhagic septicema group on 7 carbohydrates—namely, dextrose, lactose, saccharose, mannite, maltose, dulcit, and salicin. The results of agglutination tests of various strains of the hemorrhagic septicemia group with serum of rabbit immunized to an avian strain and to a porcine strain are also presented in tabular form.

Rabies vaccine canine.—Single dose treatment, J. REICHEL and J. E. SCHNEIDER (*Jour. Amer. Vet. Med. Assoc., 63 (1923), No. 1, pp. 83, 84*).—To determine whether or not a killed and noninfective rabies vaccine is as effective an immunizing agent as live vaccine, 35 dogs ranging from 6 to 34 lbs. in weight were given subcutaneous injections of 5 cc. of various vaccines as follows: Five received live vaccine 1 day old, 5 dead vaccine 1 month old, 5 dead vaccine 9 months old, and 20 dead vaccine 1 month old. During the 3 months following the vaccination, 15 of the animals died from various causes other than rabies. The 20 remaining and 9 previously-untreated dogs were then injected intraocularly with 0.1 cc. of street virus. Of the previously-vaccinated

dogs, I died from rabies and 11 from other causes, while all of the 9 control dogs died of rabies.

The effect of "arsenic-fastness" of Trypanosoma equiperdum on the ratios between the parasiticidal values of arsphenamin and neoarsphenamin, G. C. LAKE and T. F. PROBEY (*Pub. Health Rpts. [U. S.], 38 (1923), No. 24, pp. 1347–1350*).—"The minimal effective doses of a single lot each of arsphenamin and neoarsphenamin have been determined for three arsenic-fast strains of *T. equiperdum* and for one nonarsenic-fast, 'normal,' or possibly arsenic-susceptible strain. All four strains were substrains from the same common strain. With the arsenic-fast strains the mimimal effective dose for this arsphenamin and neoarsphenamin was found to be about the same and not far from 50 mg. per kilogram, whereas with the normal strain the minimal effective dose for the same arsphenamin was found to be between 3 and 4 mg. per kilogram, and for the same neosarsphenamin about 12 mg. per kilogram. No explanation is apparent as to why an arsenic-fast strain should be proportionately less resistant to arsphenamin than to neosarsphenamin."

Studies on nutrition in experimental tuberculosis.—I, The effect of the fat-soluble A vitamin on tuberculosis of the guinea pig, with especial reference to the value of cod liver oil in experimental tuberculosis, M. I. SMITH (*Amer. Rev. Tuberculosis, 7 (1923), No. 1, pp. 33–48, figs. 6*).—This paper reports the results of the effects of the administration of cod-liver oil with or without the simultaneous administration of calcium on the course of experimental tuberculosis in guinea pigs. In one series of experiments the tuberculous animals were kept on a normal diet and in another on a diet deprived wholly or partially of vitamin A. In each series control experiments were run with animals receiving olive oil in place of cod-liver oil.

In the first series of experiments, in which the normal diet was used, with the addition in some cases of 0.5 cc. of cod-liver oil supplemented or not by the intravenous injection of 60 mg. per kilogram body weight of calcium lactate, the resulting growth curves and death records showed that the administration of cod-liver oil did not lengthen the life of the tuberculous animals, but slightly modified the disease processes. The intravenous injection of calcium lactate tended to hasten the course of the disease and shorten the life of the animals.

The deficiency of vitamin A in the diet of the control animals was followed by loss in weight, beading of the costochondral junctions, and fragility of the bones. When the deficient diet was supplemented with cod-liver oil, life was prolonged and the animals were protected from developing deformities in the costochondral junctions, but there was no improvement in the growth curves.

In the tuberculous animals, whether on normal diet or the diet deficient in vitamin A, cod liver oil appeared to exercise no beneficial effect in weight curves, length of life, or extent of the disease processes.

Types of organism found in a series of tuberculous children, J. K. GORDON and E. W. BROWN (*Amer. Jour. Diseases Children, 25 (1923), No. 3, pp. 234–246*).—A summary is given of the history and clinical and pathological findings, together with the type of organism recovered, in 30 cases of tuberculosis in children from 4 months to 11 years of age from the wards of the Children's and Infants' Hospitals, Boston. A somewhat detailed account of the routine procedure employed to distinguish between human and bovine types is included.

In the total of 30 cases the bovine organism was found in 6 of the 23 children under 5 years of age and in 4 of the 7 children between the ages of 5 and 16 years. Twenty-two of the total number of cases were known to be

fatal, and of these 4 were of the bovine type. In the 12 cases in which permission for necropsy was obtained, the cases in which the point of origin of infection was found in the alimentary tract were all of bovine tuberculosis, while the human bacillus was recovered from all cases in which the point of origin was the respiratory tract. In 5 cases it was claimed that the children were exclusively breast-fed, although the reliability of this statement is considered doubtful. Of these 5 all but 1 showed the human type of organism. Of 7 cases in which a definite history of familial tuberculosis or contact with tuberculous persons was obtained, 6 proved to be infected with the human and 1 with the bovine organism.

"In consideration of the fact that the foregoing figures apply to only 30 cases of tuberculosis in infancy and childhood, no general conclusions may be reached other than that, in the Boston district, the percentage of bovine tuberculosis would appear unnecessarily high."

Blackleg in cattle, H. WELCH (*Montana Sta. Circ. 110 (1923), pp. 8, figs. 5*).—This is a practical summary of information.

Cattle ticks [in Guam], C. W. EDWARDS (*Guam Sta. Rpt. 1921, p. 2*).—The common cattle tick (*Margaropus annulatus*) is said to be one of the greatest obstacles to the work of upgrading the native cattle or maintaining pure-bred herds in Guam. Observations on grade animals indicate that the half-bloods (half Ayrshire and half native) are highly resistant to the tick-fever organism, in that they show no abnormal temperature periods, and do not show greater ill effects from the presence of the ticks than do the native cattle. The three-quarter bloods (three-fourths Ayrshire and one-fourth native), however, do not seem to be resistant, some having shown fever periods and loss of flesh when heavily infested with the parasites.

The relation of colostrum to immunity of newborn calves, J. TRAUM (*Cornell Vet., 13 (1923), No. 2, pp. 135–148*).—This is a review and discussion of recent literature on the subject.

Vaccination against sheep pox with sensitized virus after 10 years of application, J. BRIDRÉ and A. BOQUET (*Ann. Inst. Pasteur, 37 (1923), No. 3, pp. 229–233*).—This is a brief discussion of the value of the method of vaccination against sheep pox instituted by the authors in 1912 (E. S. R., 28, p. 285). It is stated that since the introduction of this vaccine over 8,000,000 sheep have been vaccinated with it in Algeria and 500,000 in France.

The extensive experience with this method of vaccination has shown that the immunity acquired 48 hours after the vaccination lasts for at least a year. The local reaction which usually follows the vaccination shows no tendency to spread and thus become a source of contamination to healthy animals. In some cases a lasting immunity is secured with no evidence of local reaction.

It is emphasized that the action of the vaccine is only preventive, and that it has no effect at all on the course of the disease which is already under way. When applied indiscriminately to a flock in which there are animals already in the incubation period of the disease, others which will come down with the disease in the 48 hours following vaccination before the establishment of immunity, and still others which escape the disease during this period, it will be only the last subjects that will escape the disease. If, however, the vaccination has been given at the first appearance of the disease, the last group will represent by far the largest part of the flock, particularly if care is taken to isolate the sick animals immediately.

Serum vaccination is considered entirely inapplicable in sheep pox, on account particularly of the varying duration of the serum immunity. It is recommended, however, as a curative measure for animals already infected.

It is stated that vaccination can be practiced on all the sheep in a flock whatever their age or physiological state. In lactating animals the injection has a tendency to decrease the milk supply temporarily. When given during pregnancy, not only the mother but the young become immune.

Stomach worms (*Texas Sta. Rpt. 1921, pp. 4, 5*).—In control work with stomach worms of goats, effective dosing was secured when the animals were deprived of food and water for 24 hours before and 20 to 24 hours after administration of 3 gm. of copper sulphate. In 2-gm. doses, efficiency of 92 and 70 per cent, respectively, was noted in two cases. Access to feed and water before and after dosing reduced the efficiency.

The common animal parasites of swine, R. Graham and I. B. Boughton (*Illinois Sta. Circ. 269 (1923), pp. 18, figs. 11*).—This is a practical summary of information.

Natural and artificial immunity of young pigs to hog cholera, R. R. Birch (*Cornell Vet., 13 (1923), No. 2, pp. 159–169*).—This is a discussion, based upon the experience of the author and other investigators, of the status of newborn pigs in regard to their immunity to hog cholera and of their proper handling in herds already infected.

In the author's opinion immunity to hog cholera of young pigs nursed by immune mothers often and perhaps usually exists, but it fails in so many cases that it is not safe to depend on it in herds which are constantly exposed to hog cholera. In such herds it is recommended that all the young pigs under 4 weeks of age be given serum treatment, followed, after they have reached the age of 12 weeks, by the simultaneous treatment. "We do not know of a single herd in which this plan has been followed with reasonable care and proved to be a failure, and we do not know of any other plan which has proved generally effective in herds which are constantly exposed to hog cholera. In herds that are not directy exposed it is safe to omit the initial dose of serum alone and give serum-virus treatment when the pigs are about 12 weeks of age, but in most of the garbage-fed herds in the East omission of the initial dose of serum will lead to disaster."

Some troubles met in immunizing against hog cholera, E. R. Steel (*Jour. Amer. Vet. Med. Assoc., 63 (1923), Nos. 1, pp. 52–59; 2, pp. 170–177*).—This is a discussion from a practitioner's viewpoint of some of the troubles encountered in immunizing against hog cholera and means of overcoming them.

Abortions and diseases of foals, H. Miessner and R. Berge (*Deut. Tierärztl. Wchnschr., 30 (1922), Nos. 37, pp. 473–482, figs. 7; 38, pp. 490–496, figs. 2; abs. in Cornell Vet., 13 (1923), No. 1, pp. 57–63*).—The authors discuss abortion under two headings, namely, (1) sporadic and (2) epizootic. Under sporadic abortions are included those due to abnormalities of the genital tract and of the fetus; twin pregnancies; traumatic injuries; improper feeding, especially food that is low in protein, poisonous, moldy, or frozen; and those due to involvement of the uterus in tuberculosis, glanders, copulation-strangles, and dourine. Under epizootic abortion are included only those caused by *Bacterium paratyphi abortus equi*. A bibliography of 88 titles is appended. The review of this paper, which is by J. Traum, includes a note (pp. 60–63) in which the more recent literature on the subject is briefly referred to.

Value of the Bordet-Gengou reaction applied to the diagnosis of equine dourine.—General observations, A. Bessemans and E. Leynen (*Compt. Rend. Soc. Biol. [Paris], 88 (1923), No. 16, pp. 1222–1225*).—A brief summary is given of the authors' experience in the use of the Bordet-Gengou reaction in the diagnosis of dourine (E. S. R., 47, p. 86).

In 55 cases false positive reactions were given which could be traced to faulty technique either in insufficient heating of the serum sample or the use of septic

material or disinfectants at the time the blood was taken. On repeating the test negative results were obtained, and the animals at no time showed any signs of dourine. The necessity is emphasized of receiving the blood in as aseptic a condition as possible and of not using any antiseptic.

All of the horses which gave a positive reaction continued to react positively during the progress of the disease. No evidence was obtained of clinical symptoms preceding the appearance of a positive reaction, but in 5 cases the reaction preceded by from 1 to 2½ months the appearance of the first clinical symptoms. All of the animals which showed no signs permitting them to be classed as suspicious gave negative reactions.

Reactions following the immunization of horses with swine erysipelas bouillon cultures, A. HUPBAUER (*Ztschr. Immunitätsf. u. Expt. Ther., I, Orig., 36 (1923), No. 4, pp. 348–355, figs. 6*).—Attention is called to the danger involved in the process of hyperimmunizing horses against swine erysipelas by the use of beef bouillon instead of horse meat or blood bouillon cultures of the organism. Cases are reported in which this was followed by severe anaphylactic reaction.

Roup.—Avian diphtheria, H. H. LEHMAN (*Vet. Med., 18 (1923), No. 6, pp. 524–526*).—This is a general discussion of the etiology, modes of transmission, symptoms, prophylaxis, and treatment of roup.

Fowl cholera and similar ailments, H. J. STAFSETH (*Michigan Sta. Quart. Bul., 5 (1923), No. 4, pp. 182–185*).—This is a brief practical summary of information.

Studies of infectious enteritis of poultry caused by Bacterium coli communis, C. C. PALMER and H. R. BAKER (*Jour. Amer. Vet. Med. Assoc., 63 (1923), No. 1, pp. 85–96, fig. 1*).—This is a report of studies of a disease which within recent years and especially during 1922 was a source of heavy losses in Delaware flocks, having assumed epizootic proportions among chickens, turkeys, and ducks.

The authors find the disease to be caused by a virulent strain of *B. coli communis*, which may occasionally be demonstrated in the blood, liver, and spleen, and usually in the intestinal wall. Satisfactory results in treating the disease have been obtained by the use of lime sulphur given to sick birds, directly or in the drinking water, and copper sulphate in sour milk. The authors feel that they have effectively checked a number of outbreaks by the judicious use of these agents, together with improving the sanitation and regulation of the diet.

Diagnosis and treatment of internal parasites, M. C. HALL (*Chicago: Vet. Med., 1923, pp. 96, figs. 87*).—This is a brief summary of information on the subject.

Natural history of the nematodes of Barbary, I, L.-G. SEURAT (*Histoire Naturelle des Nématodes de la Berbéri.—I, Morphologie, Développement, Éthologie, et Affinités des Nématodes. Algiers: Univ. Alger, Faculté Sci., Trav. Lab. Zool. Gén., 1920, pp. 221+VI, figs. 34; rev. in Trop. Vet. Bul., 11 (1923), No. 1, pp. 39–42*).—This first part of a monographic account deals with the morphology, development, etc., of nematodes. It includes a bibliography of eight pages.

RURAL ENGINEERING.

Engineering on the farm, J. T. STEWART (*Chicago: Rand McNally & Co., 1923, pp. VIII+538, figs. 415*).—This is a treatise on the application of engineering principles to agriculture, in which everything of a technical nature has been eliminated. It is confined to those engineering problems that most frequently confront the average landowner and agricultural student. It is stated that much of the text has been drawn from the files of the University of Min-

nesota. Sections are included on materials of construction, land improvement, building equipment, and mechanical equipment.

Engineering economics, J. C. L. Fish (*New York and London: McGraw-Hill Book Co., Inc., 1923, 2. ed., pp. XI+311, figs. 51*).—This is the second edition of this book, the purpose of which is to present to the engineer a working knowledge of the first principles of economics, particularly as applied to engineering construction. It contains chapters on analysis of problem of investment, interest, preliminary analysis of first cost and of operation cost, practical analysis of first cost, business units, irreducible data of the problem of investment, business statistics, miscellaneous forecasts, valuation, errors in estimating, and engineering reports.

Standard handbook for electrical engineers, F. F. Fowle (*New York and London: McGraw-Hill Book Co., Inc., 1922, 5. ed., rev., pp. XVIII+2137, figs. 1509*).—This is the fifth, revised edition of this book, covering a large amount of data of use to electrical engineers.

Sixteenth biennial report of the State engineer to the Governor of Wyoming, F. C. Emerson (*Wyo. State Engin. Bien. Rpt., 16 (1921–22), pp. 106+34, pls. 18*).—This report describes the work and expenditures of the office of the State engineer of Wyoming for the biennium 1921–1922. It contains, in addition to matter covered by the routine work of the office, a general treatise on special major undertakings, such as the reclamation of arid lands, water power development, and the handling of interstate water problems.

The bacteriological examination of water, W. L. Mallmann (*Michigan Sta. Quart. Bul., 5 (1923), No. 4, pp. 186, 187*).—Brief instructions for the collection of water samples for bacteriological examination are presented.

Sizes of pipes for water systems, H. W. Riley (*Cornell Countryman, 20 (1923), No. 7, pp. 171, 172*).—Tabular data showing the friction head of water in different sizes of galvanized pipes in feet per 100 ft. of pipe are presented and discussed.

How to use explosives in farm drainage, A. M. Goodman (*Cornell Countryman, 20 (1923), No. 7, pp. 169, 170, figs. 2*).—Practical information and tabular data on the use of explosives for the construction of drainage ditches are presented.

A treatise on the law of surveying and boundaries, F. E. Clark (*Indianapolis: Bobbs-Merrill Co., 1922, pp. XXXVII+631, figs. 117*).—This work sets forth the laws pertaining to surveying and boundaries, and discusses the problems arising in the surveying and legal professions with reference to the location and settlement of boundaries. It aims to furnish the surveyor and attorney a ready reference to the acts of Congress providing for a survey of the public lands, the instructions of the surveyor general to his deputies in executing public surveys, the suggestions to private surveyors sent out by the Commissioner of the General Land Office pertaining to the subdivisions of sections and the restoration of lost or obliterated corners, and the decisions handed down by the courts pertaining to the various phases of the subject. It contains chapters on land surveying; the survey of public lands; surveys and surveyors; some general observations; base lines, principal meridians, townships; subdividing townships and observations; subdivision of sections; fractional lots, numbering, and areas; streams, lakes, and ponds; excess and deficiency; meander corners and meander lines; marking lines and corners; identification of tract; riparian rights; restoration of lost or obliterated corners and subdivision of sections; evidence of location of corners or lines; boundaries between States and nations; the meaning of words used in descriptions; some usual and unusual questions answered; dedication and estoppel; agreements on

boundaries and surveyors; surveyors—liabilities, experts, rights; plats and platting lands; adverse possession; highways; surveys of the original thirteen States; and the rectangular system in the Dominion of Canada. Numerous diagrams and illustrations are included.

Lateral earth pressure: The accurate experimental determination of the lateral earth pressure, together with a résumé of previous experiments, J. FELD (*Amer. Soc. Civ. Engin. Proc., 49 (1923), No. 4, pp. 603–660, figs. 6*).—Experiments conducted at the University of Cincinnati are reported, which are said to embody the first complete set of tests using a large-sized apparatus for measuring directly by means of platform scales the components of the active pressure on a model wall 6 ft. high and 5 ft. wide.

Tests with sand under various conditions, using vertical and battered walls backed with wood, glass, and sheet iron, indicated the reliability of the Poncelet theory of the maximum wedge causing oblique pressure. Tests with walls battered in both directions showed that the direction of the resultant pressure is always inclined to the normal at an angle equal to the angle of friction on the back of the wall. The resultant is said to act above the third point and for a heavy surcharge as high as the 0.4 point. The amount of the horizontal component is said to be given closest by the wedge theory, taking as the angle the experimentally determined angle of internal resistance of the fill. Settling and variations in temperature were found to cause remarkable changes in the lateral pressure.

Methods of analyzing the earth-pressure problem, with restrictions on each method, are presented. These are said to be the result of a study of more than 650 references covering practically everything written on the subject of earth pressure.

Concrete: Its manufacture and use (*Milwaukee: Koehring Co., 1921, pp. 207, figs. 18*).—This is a handbook of reference to what is considered to be sound engineering practice in concrete construction, with particular reference to the erection of permanent structures and the better care of construction equipment. It contains chapters on estimating cost of concrete construction and convenient estimating tables and examples of use.

The setting of Portland cement, compiled by W. L. GADD (*Brit. Portland Cement Research Assoc. Pamphlet 1 (1922), pp. 35*).—Studies on the setting of Portland cement are summarized, the object of which was to throw further light on the subject, particularly on the cause of the change in the setting time of commercial cements which occasionally takes place during transit or storage.

It was found that the setting time of cement does not change of itself, even after prolonged storage out of contact with air. It is concluded, therefore, that there is no apparent spontaneous alteration in the chemical composition or physical structure. The time of setting of cement appeared to depend upon the proportion of combined water present in hydrated calcium aluminate or silicate, which tended to form a protective coating around the particles of cement and delayed penetration of water to the active core. The greater the quantity of water absorbed by the cement, the more impervious was the protective film and the slower was the time of setting. On the other hand, setting was accelerated by any influence which withdrew water from the cement or which attacked, destroyed, or modified the film of hydrated material, thereby enabling the gauging water to penetrate more quickly to the active core of the particle.

Changes of time of setting were brought about only by outside influences such as carbon dioxid and water vapor or active salts, which withdrew water from or acted upon the protective film of hydrous material coating the

cement grains. Cement was capable of withdrawing water from salts containing water of crystallization with which it lay in contact for some weeks. Such water hydrated the cement particles and retarded the time of setting. Cement in contact with salts containing water of crystallization which have part of such water expelled by pressure combined with the expelled water and became slower setting.

The setting time of cement resulting from the partial hydration of the particles remained unchanged, provided the material was not subjected to outside influences which affected the hydrous film coating the grains. It is stated that the reason for the acceleration or retardation of the time of setting by soluble salts is not sufficiently clear to warrant a definite conclusion being drawn as to whether the action is catalytic or not.

The conclusion is drawn that the use of gypsum as a retarder is sometimes uncertain and irregular in its effects. On the other hand, the regulation of time of setting by hydration through the medium of steam or water appears to be more permanent.

A bibliography is appended.

Posts supporting agricultural electric wires, J. H. Sourisseau (*Jour. Agr. Prat., n. ser., 37 (1922), No. 18, pp. 365–368, figs. 5*).—Experience with the creosoting of wood poles supporting rural electric lines in France is briefly described. Fir seems to be the best timber for this purpose, and well-creosoted posts have been found to last as long as 17 years without serious deterioration. In addition, posts so treated have been found to possess such high resistance as to require no insulators for wires carrying currents of from 500 to 600 volts. Insulators are required on untreated posts.

Mean effective pressures of internal-combustion engines, R. Matthews (*Power, 57 (1923), No. 11, pp. 403, 404, fig. 1*).—Graphic data from tests showing the relation of air temperature, air-to-oil ratio, air-suction pressure, and mean effective pressure in internal-combustion engines are presented and discussed.

The gas tractor in Montana, H. E. Selby (*Montana Sta. Bul. 151 (1922), pp. 24, figs. 3*).—This bulletin summarizes the replies to questionnaires filled out early in 1922 by 476 tractor owners located in 45 counties of Montana. These farmers owned 490 tractors of 36 different makes. The replies indicated that 71 per cent of the owners consider their tractors a profitable investment.

The most important advantage in the use of tractors as compared with horses is that they enable farmers to do work quickly when conditions are most favorable. The chief disadvantages are excessive cost, unsatisfactory work on wet ground, and the skill required to operate them. The data further indicate that the average amount of time that the tractors were out of order when needed was less than 5 per cent of the total time that they were used.

It is noted that many tractors were operated at much lower costs than others of the same size. The most important factor affecting the cost of operation was the number of days used annually, the cost per day being less for tractors used the greater number of days. Kerosene was cheaper than gasoline as a fuel, and the cost per day of fuel, oil, and repairs was slightly higher for the older machines.

The average number of acres of crops per farm increased 76 per cent and the average number of work horses used per 100 acres of crops decreased 51 per cent after tractors were purchased.

There was a tendency for owners to recommend tractors of larger size than they now possess.

The balancing of threshing drums and other high-speed rotating machinery (a new method), M. W. Polak (*Meded. Landbouwhoogesch.* [*Wa-*

geningen], *25* (*1923*), *No. 2, pp. 26, pl. 1, figs. 6*).—A method of detecting nonuniformities in the distribution of weights in circular machine parts rotating at high velocities, such as threshing drums, is described. The method consists in the use of one bearing as a center of rotation and another nonelastic bearing moving freely between two rigid checks at a regulable distance apart. In case of an uneven distribution of weight in the drum a clearly perceptible rattle takes place. The quantity of overweight at any point due to uneven distribution is determined by measuring the centrifugal force produced by such overweight.

It is stated that if the movable bearing is drawn onto one of the checks the rattle will not occur, provided the tractive power is equal to or greater than the centrifugal force produced by the overweight. In this event, a spring is released until the rattle occurs, and the quantity of the overweight is then read directly from an attached scale. It was found that with a threshing drum an overweight of less than 5 gm. could be detected on a radius of 13 cm. (5 in.) when operated at 1,270 r. p. m., and an overweight of 10 gm. was easily determined.

The author also draws attention to the peculiar influence of air resistance on balancing. It is stated that a one-sided air resistance behaves generally as an overweight. Other related theoretical considerations are discussed.

A report on comparative tests of the flesh and grain sides of oak leather belting, R. J. Jones (*Philadelphia: Leather Belting Exch., 1922, pp. 9, pls. 16*).—The object of this series of tests is to determine which side of an oak leather belt gives the highest transmission capacity when tested under factory conditions of service.

Under average shop tensions the capacity of the flesh side averaged from 58 to 68 per cent of the capacity possessed by the grain side. It is concluded, in general, that the grain side will transmit from one to three times as much power as the flesh side, depending upon the belt, the tension, and the conditions of service. The flesh side of some belts had a greater capacity than the grain side when first put on the pulleys, but in no case was a higher capacity obtained for the flesh side after the belts were thoroughly run-in. This is said to be due to the fact that the flesh side usually has nearly its maximum capacity at the start without running-in, while the grain side requires a period of running-in to reach this point. The time of running-in on the grain side required to bring the belts tested up to rated capacity varied from 5 hours with the better belts to 40 hours with the poorer belts, and from 20 to 63 hours was required to bring them to approximately maximum capacity.

Tests of new implements, G. Fischer (*Mitt. Deut. Landw. Gesell., 38* (*1923*), *No. 7, pp. 92–97, figs. 18*).—The results of service tests of a large number of new developments in agricultural machinery in Germany are briefly reported. These included, among other things, liquid manure pumps, garden hand plows, bone grinders, grain grinders, artificial rain apparatus, shearing machines, and cultivators.

An important improvement of the plow, E. Meyer (*Mitt. Deut. Landw. Gesell., 38* (*1923*), *No. 7, pp. 97, 98, fig. 1*).—The author briefly describes the development of a single share wheel moldboard plow, in which, apparently, all horizontal side thrust is carried by the rolling friction of an inclined wheel instead of by the land side of the ordinary moldboard plow. Test results indicate a reduction in draft due to this modification. A rearrangement and reduction of frame bracing is also said to be possible, resulting in a reduction in weight.

A convenient cattle crate, H. T. GALLAGHER (*Michigan Sta. Quart. Bul., 5 (1923), No. 4, p. 173, fig. 1*).—Drawings and a bill of material for a convenient cattle crate are briefly presented.

The flat rack, H. H. MUSSELMAN (*Michigan Sta. Quart. Bul., 5 (1923), No. 4, pp. 171, 172, fig. 1*).—Drawings and a bill of material for a flat hay rack are briefly presented.

The planning and construction of farm buildings: A modern homestead, H. P. G. MAULE (*Jour. Min. Agr. [Gt. Brit.], 29 (1922), No. 8, pp. 710–717, figs. 3*).—In a contribution from the British Ministry of Agriculture and Fisheries, the plans for new farm buildings at the Seale-Hayne Agricultural College are presented and discussed.

Greenhouse construction and heating, J. H. BEATTIE (*U. S. Dept. Agr., Farmers' Bul. 1318 (1923), pp. II+38, figs. 20*).—This discusses the construction and heating of greenhouses, and gives such practical information as will be useful to those who contemplate engaging in the greenhouse business.

RURAL ECONOMICS AND SOCIOLOGY.

Technical survey of agricultural questions (*Geneva: Internatl. Labor Off., 1921, pp. X+623*).—The material presented in this survey is largely the result of investigations made in the agricultural section of the International Labor Conference, held at Geneva in October, 1921, assisted by the social insurance and emigration and employment sections. The questions fall into two main groups as outlined in an earlier publication of the same conference (E. S. R., 45, p. 192).

The problem of interest and rent in cost determination, W. E. GRIMES (*Jour. Farm Econ., 5 (1923), No. 2, pp. 79–85*).—It is suggested that much of the controversy with regard to the inclusion of interest and rent as elements in cost statements is the result of a difference in point of view and in the purposes for which cost data are needed. These items are held to be income from the social point of view, and when cost data are viewed from this angle it is questionable if they can be truthfully called costs. From the viewpoint of the individual entrepreneur, interest and rent may or may not be considered as costs.

In the case of a farm business the operator usually furnishes part or all of the land, labor, and capital used and all of the managerial ability, and the problem becomes one of allocating the total income to the factors responsible for it. In cost statements for farm products the managerial ability of the farmer has most frequently been looked upon as the residual claimant. On most farms the factor limiting the success of the business is the ability of the operator.

From the viewpoint of the individual farmer or that of farm organization, it is deemed essential that rent and interest be included in the cost statements if they are to present data which will be comparable with similar data secured under other conditions. The problem of farm organization is not only one of whether or not interest and rent should be included but of the rates of return to be used in making computations. The rate to be used may be considered from the point of view of the operator of the farm as a borrower of capital or a renter of land, or from that of the farm operator regarded as furnishing capital goods and land to be used in production. It is believed that more farmers fall in the latter than in the former class, and for this reason it is held that a rate of return equivalent to the net return on similar capital goods and land

placed on the market more nearly represents the conditions confronting the usual farmer.

The usual accounting practices are said to have resulted in some of the interest and rent being diffused throughout the entire cost statement. It is held that a method which would keep the items of interest and rent distinct from the others and prevent this diffusion would be preferable to the method now used if results only are considered.

In conclusion, it is stated that the rent of land and interest on capital goods must be included in cost statements which are to be used for comparative purposes.

Annual report of the farm management department, J. N. LIPSCOMB (*Mississippi Sta. Rpt. 1922, pp. 32–34*).—A summary is given of observations made on the basis of farm management survey records taken in Copiah County, Miss., in 1919.

Preliminary tabulations show that the average total capital per farm was $5,621, and the average labor income $1,387. The average percentage of capital in real estate was 65.13, while the most profitable proportion was 41 per cent. This group gave an average labor income of $2,459, the next having 55 per cent gave an average labor income of $1,165, while the 65 per cent group gave $1,398, the 74 per cent group $1,487, and the 83 per cent group $553. The labor income increased as the percentage of productive animal units in the cattle increased, and fell off with the increase in hog units. It increased as the percentage of crop land in tomatoes increased up to 27 per cent and then declined, and likewise as the percentage of crop land in cabbage increased up to 27 per cent. It fell off proportionately with an increase of crop land in carrots, decreased uniformly in proportion as the acreage in corn increased, but tended to rise with a rise in the percentage of crop land in oats, the group having the highest percentage making the largest labor income. About 4 per cent each of the crop land in peas and string beans gave a higher average labor income than either the group above or below this percentage. Of the crop land in lespedeza, 12.5 per cent gave a higher return than more or less.

A farm-management survey of 83 farms in Bolivar County is noted. From 150 records taken in Madison and Hinds Counties, Miss., it is indicated that oats should be more extensively grown. Certain conclusions drawn from data taken from records and account books kept in connection with the boys' farm-management project are summarized with reference to the distribution of horse labor and man labor by months. A 5-year farm efficiency study of 25 farms in Weir community, Choctaw County, is also noted.

Organization and management of local live stock shipping associations in Minnesota, E. W. GAUMNITZ and J. D. BLACK (*Minnesota Sta. Bul. 201 (1922), pp. 77, figs. 12*).—About 655 live stock shipping associations in Minnesota are covered in this review. Data as to carloads of live stock shipping to South St. Paul by counties in 1919 are tabulated, and the distribution of live stock shipping associations in 1913–14 and in 1919–20, as well as the origin of car-lot shipments, the location and size of associations, points of consignment of live stock, feeding practices, freight rates, and seasonal prices, are illustrated on dot maps and by means of graphs. A brief discussion is given of the outstanding problems of organization. The organization of the South St. Paul center market is described in so far as it affects the business of the local associations, and the business of 104 associations covered by a detailed survey in 1919 is analyzed. The remainder of the study deals with the practical problems of management, including the interpretation of seasonal market conditions and price trends. The appendix includes sample standard articles of association and by-laws.

The farm poultry flock, H. M. Eliot (*Michigan Sta. Quart. Bul., 5 (1923), No. 4, pp. 174–178*).—A detailed report of the poultry enterprise on 70 farms in lower Michigan in 1921–22 is given.

The returns from the flocks on these farms averaged $179.22 above feed and other direct costs. They made a contribution of this amount toward farm overhead and farm profits from an average investment of $222.06, over half of which was in the value of the hens themselves. The returns after deducting the investment costs and charging labor at hired man's wages were $132.11. Comparison is made between these returns and similar data for a number of years gathered by the Bureau of Crop Estimates, U. S. D. A.

An example of scientific and industrial organization in agriculture: The farm and sugar factory of Roye in Santerre, D.-J. Longuet (*Une Organisation Scientifique et Industrielle de l'Agriculture: Le Domaine et la Sucrerie de Roye en Santerre. Thesis, Inst. Agr., Beauvais, 1922, pp. 160, pls. 7*).—A study is made of a particular farm of 937 hectares (2,314 acres) cultivated in three divisions of 431, 226, and 280 hectares, respectively. This is located in the region known as the Santerre in Picardy. The particular aim is to set forth the accomplishments of 10 years in the way of organization. The author describes the crop rotations, the farm animals that are kept, the work of restoration since the war, and the highly organized sugar factory that is maintained.

[Report of the Kansas Station] department of agricultural economics (*Kansas Sta. Bien. Rpt. 1921–22, pp. 5, 7, 8*).—In addition to summarizing the conclusions of a study of the farm storage of wheat previously noted (E. S. R., 48, p. 687), a project concerned with local Kansas grain elevators begun June 1, 1921, is described.

There have been received 403 returns, and a preliminary summary of costs of operation for 75 independent and 78 cooperative elevators indicates that the total margin necessary for meeting costs was practically the same for both types. This seems to indicate that the principal benefit to the producer from the local cooperative elevator as now operated in Kansas comes from the competition it affords.

A census of the local elevators in the State has been made for 1920 and for 1921.

Marketing the early potato crop, G. B. Fiske and P. Froehlich (*U. S. Dept. Agr., Farmers' Bul. 1316 (1923), pp. II+33, figs. 18*).—The principal early potato crop regions, shipping stations, and dates are defined and mapped, and their relative importance pointed out. The kind and source of the information which the grower should use are described, and directions are given for making use of it in marketing his crop. Descriptions are given by field representatives of the Department of some of the largest and best developed shipping sections, such as Hastings, Fla., the Beaufort and Charleston sections in South Carolina, the Norfolk and Eastern Shore sections of Virginia, the Eastern Shore of Maryland, and southern New Jersey. The important sections in the West which are noted are the Eagle Lake district of Texas, the Arkansas Valley of Oklahoma and Arkansas, and the Kaw Valley of Kansas.

Farmers' Market Bulletin (*North Carolina Sta. Farmers' Market Bul., 10 (1923), No. 62, pp. 8*).—A brief review of the rapid increase in the production of certified potato seed and a note with reference to the increased yield derived from the use of certified seed potatoes are included in this number, together with the usual partial list of products which farmers have for sale.

Fallacies of a plan to fix prices of farm products by Government control of the exportable surplus, E. Englund (*Jour. Farm Econ., 5 (1923), No. 2, pp. 86–101*).—This is a statement of various aspects of the proposed plan to stabilize

the price of certain farm products and to point out the consequences that would in all probability follow its adoption.

A composite of the plans that have been proposed is referred to as one plan containing four main provisions. (1) The Government would determine the price at which farm products included in the guaranty would have pre-war purchasing power. (2) The Government would assure this price to producers by offering to purchase at this figure all commodities within the guaranty not taken by other buyers at the price set by the Government. Buyers would be forced to pay the guaranteed price, and the general price level of these commodities would be forced up to the level of the guaranty. (3) The Government would sell the surplus at the best possible advantage. (4) A tariff would be enacted sufficiently high to prevent the importation of the farm products included in these provisions.

One proposal, known as the "Moline plan," is given special mention because it represents an attempt to avoid requiring the Government to bear the difference between the world market price and the stabilized domestic price on the exportable surplus.

Certain conditions pertaining to successful dumping are pointed out as being entirely absent in agricultural production. These conditions are that a considerable degree of monopoly control is necessary, that the cost of production per unit should decrease with an increase in the quantity produced, and that the commodities must be of such a nature that the difference between the price charged at home and abroad will not be clearly and universally recognized at home. The futility of the hope that world prices of farm products can be materially influenced by a unified control of the exportable United States surplus hinges upon the extent of the areas producing these products, the highly competitive nature of world production, the comparatively small percentages that the U. S. exports of many products make of the total production of all other countries and total world exports, and the fact that a new surplus is continually coming on the market to defeat the possibilty of holding one year's crop for higher world prices.

A number of probable economic and political consequences of the plan are discussed.

Farmers' cooperation in Minnesota, 1917–1922, H. B. PRICE (*Minnesota Sta. Bul. 202 (1923), pp. 78, figs. 9*).—The purpose of this study is to analyze the statistics of cooperative associations collected since 1917 (E. S. R., 42, p. 391).

An increase is noted in the number of associations and in the volume of their business, particularly in the case of organizations selling farmers' produce, comprising 45 per cent of the total number of cooperative associations and accounting for approximately one-half of the total gain. Of these the potato and the live stock shipping associations and the farmers' elevators have made the greatest gains. Farmers' telephone companies rank second in total number of associations. Of the 11 cooperative central marketing organizations, 8 have been established since 1917, and it is deemed significant that these recently organized federations are made up of local cooperative marketing associations rather than those that are owned by individual producers.

A tendency to effect a larger, more economical business unit is pointed out, and there seems to have been an attempt to define the duties of officers and the relation of the association to its members and patrons more specifically in the by-laws. The membership contract has come into somewhat wider use, and a greater interest is shown in proper accounting systems.

Statistics are tabulated and represented on dot maps for cooperative creameries, cheese factories, farmers' elevators, potato shipping associations, coopera-

tive stores, live stock marketing associations, and farmers' mutual insurance companies. Numerous others are treated more briefly. A list of cooperative associations in Minnesota in 1922 is given.

The productivity of hill farming, J. P. HOWELL (*London: Oxford Univ. Press; New York: Oxford Univ. Press, Amer. Branch, 1922, pp. 23+[3]*).—An inquiry was instituted in the spring of 1918 by the British Food Production Department, the object of which was to gather information in regard to the yield of mutton, wool, and beef; the management and quality of the stock; the extent to which bracken, gorse, and heather affect the value of grazing; the possibility of improving hill land by manuring and drainage and of growing more winter feed; and the need for shelter. A summary is given of data collected on visits to 35 farms in the north and west of England and in Wales. A systematic inquiry into the diseases affecting sheep; the burning of heather, gorse, and grasses; the more effective control of rams on uninclosed sheep walks; and more efficient management of commons are recommended.

Tanana Valley crop production, G. W. GASSER (*Alaska Stas. Rpt. 1921, p. 32*).—In this section of the report of work at the Fairbanks Station data compiled by the Tanana Valley Agricultural Association are given which indicate the area producing and the quantity produced of vegetables, potatoes, oat hay, oats and barley, and wheat. The organization of boys' and girls' pig and chicken clubs under the management of the same association is noted, together with the operation of a small flour mill.

[Progress report of the work of the Manitoba Agricultural Survey], J. BRACKEN (*[Winnipeg: Manitoba Dept. Agr. and Immigr., 1921], pp. 15*).—This is a mimeographed report on the results so far accomplished, including a detailed survey of 15 representative municipalities in the Province and a general study of the whole of the settled area. The features inquired into were crop yields; soils; climatic conditions; farm organization; marketing practices; the financial status of the farmers; the distribution, increase, movement, and nationalities of the population; and the living conditions in the various communities.

Some of the charts and maps accompanying the progress report on the Manitoba Agricultural Survey, 1921 (*[Winnipeg: Manitoba Dept. Agr. and Immigr., 1921], pp. 75, pls. 7, figs. 119*).—Numerous maps and graphs depict the data collected in the survey noted above.

Live stock and animal products statistics, 1921, R. H. COATS (*Canada Bur. Statis., Live Stock and Anim. Prod. Statis., 1921, pp. 66*).—The numbers and values of animals in Canada and its provinces, animals slaughtered, animal products sold, and meat and live stock in other countries are given for 1921.

AGRICULTURAL EDUCATION.

Proceedings of the thirty-fifth annual convention of the Association of Land-Grant Colleges (*Assoc. Land-Grant Cols. Proc., 35 (1921), pp. 364, fig. 1*).—The usual lists of institutions and delegates and minutes of the sessions held at New Orleans, La., November 8–10, 1921, are given, together with officers' and committee reports, memorials, a letter from the Secretary of Agriculture, a selected list of references on rural economics and sociology, 1913–1921, prepared by M. L. Gericke, and papers, many of which have been noted editorially (E. S. R., 45, p. 701), as follows: The Relation of the Federal Bureau of Education to the State Universities and Colleges, by J. J. Tigert; The Agricultural Experiment Stations in Middle Life and After, by H. L. Russell; The World's Need of Russia, by A. E. Taylor; Department Extension Plans, by C. W. Pugsley; The Graduate Work in the Department of Agricul-

ture, by E. D. Ball; The Supreme Challenge, by C. E. Gunnels; Improvement of College Teaching, by T. H. Eaton; Some Basic Principles Underlying the Curriculum of the College of Agriculture, by C. R. Woodward; The Curriculum of the College of Agriculture, by J. F. Duggar; The International Institute of Agriculture at Rome, by L. M. Estabrook; What Are the Aims of Collegiate Instruction in Agriculture? by A. Vivian; Federal and State Cooperation in Cereal Research, by C. R. Ball; How to Secure National Interest in the Purnell Bill, by G. I. Christie; Securing Publicity and Support for the Purnell Bill, within the Several States, by E. C. Johnson; Position of the Experiment Station in the College of Agriculture, by E. W. Allen; Farm Population Studies to Be Conducted by Agricultural Experiment Stations, by C. J. Galpin; Agricultural Research in Relation to the Public Welfare, by R. W. Thatcher and E. W. Allen; How Shall We Bring Our Home Demonstration Work to Fuller Development? by C. B. Smith, B. H. Crocheron, and L. A. Clinton; Agricultural Extension Service in Economics, by H. C. Taylor; An Extension Program in Rural Social Organization, by E. D. Sanderson; The Relation of an Extension Program to the Work of an Experiment Station, by W. F. Handschin; Education for Extension Workers, by W. R. Perkins; Methods of Building an Extension Program Adapted to the Needs of Local Communities, by W. A. Lloyd; The Responsibility of the Extension Specialist and the County Agent in Developing and Carrying Out a Project, by P. V. Maris; Some of the Problems of the Engineering College Executive, by C. R. Richards; Improving the Quality of Engineering Instruction, by J. R. Benton, O. J. Ferguson, W. N. Gladson, and O. M. Leland; The History of Engineering Experiment Stations, by L. E. Blauch; Progress in Engineering Research during 1921, by A. Marston; Extension Education and Its Possible Service, by R. L. Sackett; The Place of Women in a Unified Extension Program, by C. W. Pugsley; Relation of the Extension Specialist to the Resident Staff in Home Economics, by A. R. Mann; Some Standards for Research in Home Economics, by C. F. Langworthy; What Can We Do to Promote the Establishment of High Standards in Research? by M. C. Denton; Organization of a College Course on Child Care, by E. N. White; Training of Women for Extension Work, by M. J. Reese; and The Home Bureau, by Mrs. A. E. Brigden.

List of workers in subjects pertaining to agriculture.—II, State agricultural colleges and experiment stations, 1922–23 (*U. S. Dept. Agr., Misc. Circ. 4 (1923), pp. IV+108*).—This list, compiled by M. A. Agnew and B. T. Richardson, gives the usual lists of the faculty and staff at the State agricultural colleges and experiment stations directly engaged in teaching, investigation, or demonstration in agriculture and home economics.

State program for supervised practice work, R. D. Maltby (*Vocat. Ed. Mag., 1 (1923), No. 8, pp. 572–575, figs. 2*).—Seven phases of supervised practice work, each of which has been carried to success by one or more States, are brought together here into a four-year program, including the project to be taken in relation to the instruction; supplementary farm practice which will include minor projects or a series of farm jobs in relation to instruction or both; improvement work which will grow out of previous years' supervised practice; farm mechanics, or shop jobs which are definitely related to the shop instruction at the school; school plats; group or class projects, including class enterprises, cooperative marketing of pupils' products, contract jobs, and community service work by the class; and farm labor. Each is briefly discussed.

The limitations of the project method, W. W. Charters (*Vocat. Ed. Mag., 1 (1923), No. 8, pp. 568–570*).—Five limitations of the project method are discussed here. The projects which are to be used during school life must all

be worked out in sufficient detail to insure the inclusion of all the important skill and information which will be needed outside of school. There has not yet been presented a system of projects so completely dovetailed that they will give both the kind of information and skill and the amount of repetition which is necessary for efficient retention. When the project method is used care must be taken to give the material taught in different projects its proper systematic organization. There is not time to teach everything by the project method. A project must conform to natural conditions and parallel out-of-school situations.

Interpreting local practices in building agricultural curriculums, A. K. GETMAN (*Vocat. Ed. Mag., 1 (1923), No. 9, pp. 653–657*).—A summary is given of two farm enterprise surveys, one of 55 farms in the vicinity of Richmond, Ill., and the other of 120 farms carried out by the teacher of agriculture at Geneva, N. Y. The dominant types of farming were determined, and it is suggested in this article in what way such information may be used in curriculum building.

The School of Agriculture of the University of Cambridge, T. B. WOOD (*Estate Mag., 22 (1922), No. 6, pp. 384–387*).—This school of agriculture is noted as one of the most recently established scientific departments provided by the University of Cambridge for the colleges collectively. It receives students from all of the colleges, and it is possible, also, for a student to become a member of the university without joining a college. Two distinct types of instruction are given, namely, a general all-round course of instruction in agriculture, estate management, forestry, horticulture, and the allied sciences, and special two-year courses for advanced students in agriculture or in allied branches of science, such as botany and chemistry.

The work of the Plant Breeding Institute and of the Animal Nutrition Institute is briefly noted.

Vocational education in farming occupations, T. H. EATON (*Philadelphia and London: J. B. Lippincott Co., 1923, pp. 374, figs. 2*).—This treatise deals with the social purpose, principles of organization, content, and method of vocational education in farming.

It is held that to reach all the boys and girls of the countryside prevocational education must be the work of the public schools. The significance of the business undertaking and productive enterprise phases of the vocation of farming is discussed with reference to the size of the trial undertakings planned for educational purposes, the author considering that definite benefit is afforded in giving prospective farmers experience as nearly representative of the vocation as possible. It is emphasized that local types of farming and the characteristics of neighborhoods and of the pupils themselves must be taken into consideration in the selection of the content of courses.

A brief résumé of types of studies which should enter into the curriculum of the high school for the prospective farmer is given, including mathematics; biological, physical, and social science; health and recreation; music; English; and history and biography. The forms of teaching discussed are supervised work on farms, directed farm studies, construction and repair, and laboratory work. One chapter is devoted to grading and promotion.

The farmer in the Tropics and subtropical regions, O. WOHLFARTH (*Der Landwirt der Tropen und Halbtropen. Berlin-Wilmersdorf: Hermann Paetel, 1921, pp. 131*).—This is an elementary reader on the subject of tropical agriculture. It describes the general agricultural conditions which would be encountered by the white man, and has chapters devoted to climate, soils, plants, animals, the native labor supply and labor problems, returns, education, and other topics.

Educational milk-for-health campaigns, J. M. HOOVER (*U. S. Dept. Agr., Dept. Circ. 250 (1923), pp. 36, figs. 22*).—Directions are given for organizing a local milk campaign, outlining the plan of approach which includes preliminary conferences, community committee meetings, and the speakers' training school. Follow-up work is described as consisting of milk sale reports, physical and dietary surveys, and milk feeding demonstrations. The functions and duties of numerous committees and subcommittees are set forth, and various blank forms and sample records are reproduced. Suggestions are made for posters and other forms of publicity.

Baking club manual, B. E. SCHOLES and H. M. PHILLIPS (*Illinois Sta. Circ. 267 (1923), pp. 4–56, figs. 11*).—Two types of cakes, shortened and unshortened, as well as cookies, pies, and puddings are considered in this manual for girls' club members who have accomplished the tasks outlined in the earlier one (E. S. R., 47, p. 696). Both large and small recipes are given, and methods and equipment are described.

Cooperative extension work, 1921 (*U. S. Dept. Agr., Coop. Ext. Work, 1921, pp. 46*).—These pages report the organization, personnel, funds, and results of cooperative extension work in agriculture and home economics, with particular reference to crop and animal production, rodent pest control, cooperative buying and selling, the farm home, and work with negroes. A brief note is devoted to farmers' institutes, and tables 1 and 2 give statistics with reference to them. Tables 3 and 4 summarize some of the outstanding results of extension work in 1921, with comparisons for earlier years and with data from the census of 1920 showing the extent to which extension work is influencing the agricultural industry as a whole. Table 5 relates to boys' and girls' club work. The following tables up to and including No. 17 show expenditures, staff, and publications.

Report of the superintendent of extension, W. J. GREEN (*Guam Sta. Rpt. 1921, pp. 27–41, pls. 2*).—Extension activities of the Guam Station include adult demonstration work, extension work with crops and improved machinery, a Better Sires—Better Stock campaign, school gardens, and boys' and girls' club work. The last is carried on in close cooperation with the schools of the district and is required in the schools of all outlying districts. Two contests for club members were held at the Guam Industrial Fair in 1921, one in judging live stock and the other in judging crops. The work of corn, bean, garden, taro and root crop, copra, pig, and poultry clubs is noted briefly.

MISCELLANEOUS.

Report of Alaska Stations, 1921, C. C. GEORGESON ET AL. (*Alaska Stas. Rpt. 1921, pp. IV+58, pls. 12*).—This contains the organization list and a report of the several lines of work carried on during the fiscal year ended June 30, 1921. Meteorological data and accounts of the extensive tests with field and garden crops are abstracted elsewhere in this issue.

Thirty-fifth Annual Report of Colorado Station, 1922, C. P. GILLETTE ET AL. (*Colorado Sta. Rpt. 1922, pp. 30*).—This contains the organization list, a financial statement for the fiscal year ended June 30, 1922, a report of the director on the work of the station, and departmental reports. The experimental work reported is for the most part abstracted elsewhere in this issue.

Report of the Guam Station, 1921, C. W. EDWARDS ET AL. (*Guam Sta. Rpt. 1921, pp. IV+43, pls. 6*).—This contains reports of the animal husbandman in charge, the assistant in agronomy and horticulture, and the superintendent of extension, and meteorological observations. The experimental work recorded is for the most part abstracted elsewhere in this issue.

Report of Kansas Station, 1921–22, F. D. FARRELL (*Kansas Sta. Bien. Rpt. 1921–22, pp. 45, figs. 5*).—This contains the organization list, financial statements for the biennium ended June 30, 1922, and a report of the director summarizing the work and publications of the station. The experimental work recorded not previously noted is for the most part abstracted elsewhere in this issue.

Thirty-fifth Annual Report of Mississippi Station, 1922, J. R. RICKS ET AL. (*Mississippi Sta. Rpt. 1922, pp. 59*).—This contains the organization list, a report of the director on the work and publications of the station, a financial statement for the fiscal year ended June 30, 1922, and departmental reports, the experimental work in which is for the most part abstracted elsewhere in this issue.

The Mississippi Agricultural Experiment Stations: An historical sketch, J. W. BAILEY (*Mississippi Sta. Bul. 216 (1923), pp. 56*).—This is an account of the establishment and development of the station and its various substations, including data regarding its finances and personnel and a list of its publications to March 1, 1923.

New facts for Oklahoma farmers, C. T. DOWELL (*Oklahoma Sta. Rpt. 1922, pp. 29, fig. 1*).—This, the thirty-first annual report of the station, contains a report of the director embodying some of the important results obtained by the various departments during the last five of six years, and a financial statement for the fiscal year ended June 30, 1922. The experimental work reported is for the most part abstracted elsewhere in this issue.

Thirty-fourth Annual Report of Texas Station, 1921, B. YOUNGBLOOD (*Texas Sta. Rpt. 1921, pp. 48*).—This contains a report of the director on the work of the station and the various substations, and a financial statement for the Federal funds for the fiscal year ended June 30, 1921, and for various State funds for the fiscal year ended August 31, 1921. The experimental work reported is for the most part abstracted elsewhere in this issue.

Thirty-second Annual Report of Wyoming Station, 1922, J. A. HILL ET. AL. (*Wyoming Sta. Rpt. 1922, pp. 139–170*).—This contains the organization list, a financial statement for the fiscal year ended June 30, 1922, reports of the acting director and heads of departments, and meteorological observations. The experimental work reported is for the most part abstracted elsewhere in this issue.

Bulletin summary (*Massachusetts Sta. Circ. 70 (1922), pp. 3*).—Brief summaries are given of Bulletins 211–214 and Control Series Bulletins 19–22, all of which have been previously noted.

Quarterly Bulletin of the Michigan Experiment Station, edited by R. S. SHAW and E. B. HILL (*Michigan Sta. Quart. Bul., 5 (1923), No. 4, pp. 155–201, figs. 9*).—In addition to articles abstracted elsewhere in this issue, this number contains the following: Sugar Beet Station Established at M. A. C., by J. F. Cox; Recent M. A. C. Extension Publications; A New Clover Experiment Station, by J. F. Cox; Grape Production in Michigan; A Northern Seed-maturing Hemp, by F. A. Spragg; and The Striped Cucumber Beetle and A Repellant for Flat-headed Borers, both by R. H. Pettit.

NOTES.

Alabama Tuskegee Station.—At the fourteenth annual conference of the National Association for the Advancement of Colored People, Director George W. Carver was granted the Spingarn medal for his discoveries in agricultural chemistry. His work for the wider utilization of the sweet potato and peanut, from which he has prepared 118 and 165 useful products, respectively, formed the basis of the award.

California University and Station.—The work on the biological control of insects, formerly conducted by the State department of agriculture, has been transferred to the station. The chief of the bureau of pest control, Harry S. Smith, has been appointed associate professor of entomology in the university, with headquarters at Riverside, beginning July 1. H. M. Armitage, entomologist, and A. J. Bosinger and Harold Compere, assistant entomologists, will be stationed at the Whittier laboratory, which is to be retained for this work. The regulatory and police functions of the bureau of pest control will be continued by the department.

W. V. Cruess, associate professor of fruit products, has been granted sabbatical leave for six months, beginning October 1, to be spent in a study of the manufacture and preservation of olive products in Spain and France; apple by-products, dehydration, and milk products in Switzerland, Holland, and Belgium; and marmalade, jams, and preserves in England and Scotland. Some of the leading fruit and vegetable products factories in the eastern part of this country will also be visited, as well as the chief educational institutions dealing with horticulture.

Iowa Station.—O. Wallace Park, assistant chief of apiculture, has accepted a position as assistant professor of zoology in charge of apiculture at the University of Illinois.

Minnesota University and Station.—Allan B. Rayburn, assistant professor of dairy husbandry in the university and assistant in dairy husbandry in the station, resigned in August. E. C. Stakman, professor of plant pathology and associate plant pathologist, has been given leave of absence until November 5 to attend meetings of the Pan-Pacific Scientific Congress in Australia. Recent appointments include H. W. Vaughan as professor of animal husbandry, Otto G. Schaefer, assistant professor of dairy husbandry extension in the Pennsylvania College, as associate professor of dairy husbandry, and Aubrey C. Hildreth as research assistant in horticulture.

Missouri Poultry Station.—The station recently presented exhibits at the State Fair, held at Sedalia, consisting of a model of a 10-acre farm laid out according to scale, a display of museum specimens of poultry diseases, models of developing chicks, and microscopic slides showing the causative agents of poultry diseases. These exhibits attracted much attention from those in attendance at the fair.

A demonstration car is to be equipped by the station and sent out over the Missouri, Kansas & Texas Railroad to indicate to small poultry keepers better methods of poultry husbandry.

Work has been commenced on a poultry hospital in connection with pathological investigations.

New York State Station.—The Rochester and Syracuse sections of the American Chemical Society held a joint meeting at the station September 29. The formal session of the meeting was devoted to a paper by Dr. D. D. Van Slyke, of the Rockefeller Institute, on Factors Influencing the Distribution of Electrolytes and Water in Blood. Doctor Van Slyke has recently returned from China, where he organized research work in biological chemistry at the Union Medical College of Peking.

North Carolina College and Station.—E. C. Brooks, formerly State superintendent of education, has been appointed president of the college vice Dr. W. C. Riddick, who has become dean of the school of engineering.

The instruction, experimental, and extension work in agriculture have all been combined under B. W. Kilgore, director of the station and extension service, who now becomes in addition dean of the school of agriculture. B. F. Brown, formerly of the division of markets, has been appointed dean of the school of rural economics and business administration, and Dr. C. C. Taylor, formerly professor of rural organization, has been appointed dean of the graduate school.

Those members of the station and extension service staffs who have been housed in the offices of the State department of agriculture have now moved into the new $300,000 building recently constructed by the State for that department. This building is one of the most beautiful in the group of State buildings in Raleigh and gives added facilities for carrying on the agricultural work of the State.

The substation farms are growing in favor with the farmers of North Carolina, due in part to the annual farmers' field days which are held on the farms each summer. At a recent picnic and field day on the Piedmont Substation farm near Statesville, 2,000 automobiles were parked on the grounds during the day, and it is estimated that 10,000 people were present. Another field day was held at the Edgecombe Substation farm August 9, when practically all the prominent farmers of that territory inspected the farm and a speaking program and barbecue were given. The field day at the Mountain Substation farm near Swannanoa was held August 16, with 250 invited farmers and their families present. The Coastal Plain Substation farm held its field day and farmers' picnic September 13. These picnics and field days are bringing the substation farms into closer contact with the public and are familiarizing it with the various lines of work carried on, so that inquiries and visits are continued during the entire year and the farms are becoming community centers for the dissemination of sound information.

North Dakota Station.—N. B. Guerrant, assistant in agricultural chemistry, resigned July 20 and has been succeeded by L. L. Nesbitt.

Ohio State University and Station.—President W. O. Thompson has been given leave of absence from March 1, 1924, to July 1, 1926, and is expecting to make a tour of the higher institutions of learning in the leading countries of the world. Dean John J. Adams of the College of Law has been designated as acting president during his absence.

In the station, H. C. Young, Ph. D., serologist in the U. S. Army during the World War and subsequently pathologist in the Crop Protection Institute, has been appointed chief of the department of botany, succeeding A. D. Selby, who has resigned after 29 years' service to give personal attention to his business interests. R. C. Miller and J. B. Keil, assistants in nutrition and horticulture, respectively, have resigned, the former to take up graduate work at Cornell

University, and the latter to engage in commercial work. T. C. Green has been appointed assistant in the department of soils.

Oregon College.—J. Leo Fairbanks, supervisor of art in the public schools of Salt Lake City, Utah, has been appointed head of the department of art and rural architecture.

Pennsylvania College and Station.—The resignations are noted of W. C. Pelton as professor of vegetable gardening, T. B. Charles as assistant professor of dairy husbandry, J. R. Haag as instructor in chemical agriculture, and S. S. Decker and John Pierson as assistants in dairy husbandry. A. K. Anderson, Ph. D., has been appointed associate professor of chemical agriculture, beginning September 1. Other new appointments include Madge T. Bogart as professor of home economics extension, M. H. Brightman as assistant professor of poultry husbandry, P. T. Brown as assistant professor of animal husbandry extension, Perry T. Kistler as assistant in poultry husbandry, and J. D. Romaine as assistant in soil technology.

Porto Rico Insular Station.—Dr. M. T. Cook, professor of plant pathology at Rutgers College and plant pathologist in the New Jersey stations, has been appointed expert on the diseases of sugar cane.

Tennessee University and Station.—Vice Dean C. A. Willson has been appointed dean of the College of Agriculture. Vice Director C. A. Mooers has been appointed director of the station.

Texas Station.—Following the wet spring and the consequent rotting of many seeds, an experiment was started with sunflowers as a forage and silage crop. A field of three acres planted May 5 had made a growth higher than a man's head by July 1, indicating a heavy yield as a soiling crop in less than 60 days. Encouraging results have also been obtained in feeding the crop, and it is believed that sunflowers offer considerable possibilities as forage and silage under the station conditions.

Wisconsin University and Station.—A memorial apicultural library dedicated to the memory of Dr. Charles C. Miller, a pioneer beekeeper of Marengo, Ill., has been established by the university. Funds of over $1,500 have been subscribed by beekeepers from various parts of the world, and the interest from this sum will be used for making additions to the library. Several hundred volumes of journals and books have also been donated by beekeepers and scientists, and it is the plan of the committee in charge to develop one of the best apicultural libraries in existence. The library was dedicated at the fifth annual conference of beekeepers at the university during the week of August 13, and was followed by a pilgrimage by automobile from Madison to Marengo, where the dedication was completed and a memorial tablet placed in the local church.

An oil painting of the late John A. Craig, the first professor of animal husbandry in the College of Agriculture, has been presented to the university.

The Southern Wisconsin Cheese Maker's and Dairyman's Association has engaged C. A. Eckberg to assist in the field work of inspecting Swiss cheese factories. This work is to be under the general direction of C. M. Gere, who is the Swiss cheese specialist of the station and is located at Brodhead in connection with the introduction of bacterial cultures in the Swiss cheese industry.

The annual potato tour conducted through eight of the leading counties early in August is reported to have been very successful. Buyers from both the Southern and Eastern States were present and expressed themselves as much pleased with the quality of Wisconsin certified seed potato stock.

Several hundred farmers representing 15 States attended the annual summer meeting of the National Soy Bean Growers Association which was held at the College of Agriculture September 11. The forenoon program consisted of demonstrations at the university farm with fields of soy beans in all stages of growth that were available. Among the outstanding features of the machinery exhibit at the meeting was a new device which grinds the entire soy bean plant as harvested for stock feed. By grinding the fiber-containing material together with the beans, the former danger of spoilage because of the large amount of oil present is overcome. The fibrous material absorbs the oil and makes a feed containing about 40 per cent of protein, which is said to keep almost indefinitely. A new soy bean harvesting machine, which is a combined harvester and thresher for seed beans, was also demonstrated. This machine leaves the stalks on the field, cleans the seed, and harvests two rows at a time.

The Coddington Substation held its third annual demonstration day August 8. The demonstration dealt with the effects of fertilizers on the various crops grown on the peat soils; frost-enduring root, hay, and grain crops; peat soil rotations; flax, hemp, sunflowers, alfalfa, and potatoes on peat; tillage and weed control on peat; and emergency hay crops.

Wyoming University and Station.—Recent appointments include F. J. Kohn as instructor in poultry husbandry and assistant in the station and H. F. Eaton as assistant wool specialist.

U. S. Department of Agriculture.—Howard M. Gore, who has been in charge of the Division of Trade Practices since the passage of the packers and stockyards act, was appointed Assistant Secretary of Agriculture September 17.

Clyde W. Warburton of the Office of Cereal Investigations, Bureau of Plant Industry, has been appointed director of extension work, effective September 24. This is a new position coordinate with the directors of research and regulatory work and carrying with it general direction and supervision of all extension activities of the Department.

Food Research Laboratory in Japan.—According to a note in *Science*, two contributions of 200,000 yen ($100,000) each have been made to Keio University by Barons Masuda and Mitsui for the purpose of establishing a food research laboratory in connection with the university hospital. This food laboratory will be the first of its kind in Japan and will work primarily with a view to improving the health of the Japanese people. Drs. Kenta Omori and Z. Kawakami are to be in charge of the work and will make a study of similar undertakings in North America and Europe.

New Journals.—The *Journal of Helminthology*, issued in five bimonthly parts during the year, is primarily intended as a medium for orginal communications by the staff and associated workers of the various sections of the department of helminthology at the London School of Tropical Medicine. The initial number contains the following articles: Observations on the Morphology and Life History of *Ascaris columnaris* Leidy, a Nematode Parasite of the Skunk, by T. Goodey and T. W. M. Cameron; Observations on the Genus *Paragonimus* Braum with a Redescription of P. *compactus* (Cobbold, 1859) 1899, and Some New and Little Known Helminths from British Guiana, both by G. M. Vevers; On the Freeliving Larval Stages of the Nematode *Bunostomum trigonocephalum* (Rud.), a Parasite of Sheep, by A. J. Hesse; and On a Trematode from the Gall Bladder of *Naja bungarus*, with an Emendment of the Genus *Xenopharynx* Nicoll, 1912, by M. Khalil.

Revue Pratique des Maladies des Pays Chaudes is being published in Paris with M. Zeitoun as editor. The initial number contains several original articles dealing with tropical diseases, including An Introduction to the Study of Exotic Pathology, by Professor Reynaud; Progress in the Treatment of Pro-

tozoan Diseases, by Professor Tanon, and The Rôle of Virus Reservoirs and Germ Carriers in Exotic Pathology, by Professor Nattan-Larrier. Reviews, news notes, and similar information are included.

Miscellaneous.—Arbor Lodge, the estate of former Secretary of Agriculture J. Sterling Morton, has been transferred by his son, Joy Morton, to the State of Nebraska as a gift. The tract comprises sixty acres, most of which is now heavily wooded, the trees having been planted by Secretary Morton and his wife about sixty years ago and its establishment having had much influence in stimulating tree planting on the prairies and the development of Arbor Day. An adjoining tract of twenty acres, known as Morton Park, has also been transferred to the State by the city of Nebraska City, and a State appropriation of $5,000 for the maintenance of the entire property as a museum of natural history has been approved.

The degree of bachelor of agriculture has recently been established in the Faculty of Science of Bristol University. A five-year course is prescribed for the degree, two years being spent in the university and the Agricultural and Horticultural Research Station at Long Ashton, two years in the Royal Agricultural College, Cirencester, and one year on a selected farm.

Construction is soon to be begun for a new building for the department of agriculture of the University of Leeds. The university is providing a site 190 by 125 ft., and funds for the building have been derived mainly from a Treasury grant of £15,000, £10,000 from the Yorkshire Council for agricultural education, £10,000 from a gift by the late Walter Morrison, and numerous other donations. The balance required is to be contributed by the university.

The negro farmers of Alabama have presented an automobile truck equipped as a "school on wheels" to the Federal and State extension service. This will be known as the Booker T. Washington School on Wheels and will make regular trips from Montgomery into the country districts to hold institutes. It is fitted up with a motion-picture projector and a phonograph for demonstrations, as well as other improved equipment.

Dr. E. G. Hood, lecturer in bacteriology at Macdonald College, has been appointed chief of the division of dairy research, a newly created division in the Dairy and Cold Storage Branch of the Dominion of Canada.

H. A. Lee, director of experimental work and other activities for the Philippine Sugar Association, has resigned to accept a position with the Hawaiian Sugar Planters' Association, effective the latter part of October.

F. W. Taylor is establishing a series of experimental stations in Salvador for the San Salvador Department of Agriculture.

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EXPERIMENT STATION RECORD.

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RECENT WORK IN AGRICULTURAL SCIENCE.

AGRICULTURAL CHEMISTRY—AGROTECHNY.

An advanced laboratory manual of organic chemistry, M. HEIDELBERGER (*New York: Chem. Catalog. Co., Inc., 1923, pp. 103, fig. 1*).—The preparations included in this manual have been selected "with the object of providing a brief advanced course in manipulative organic chemistry embodying experiments scattered as widely as possible over the important types of substances and reactions." The selection includes about 50 preparations of aliphatic and aromatic compounds and products of technical and biological as well as theoretical importance.

Analysis and determination of the constitution of organic compounds, H. MEYER (*Analyse und Konstitutionsermittlung Organischer Verbindungen. Berlin: Julius Springer, 1922, 4. ed., rev. and enl., pp. XXXVI+1191, figs. 360*).—This is the fourth edition of this work, an earlier edition of which has been noted previously (E. S. R., 24, p. 408).

Calculation of isoelectric points, P. A. LEVENE and H. S. SIMMS (*Jour. Biol. Chem., 55 (1923), No. 4, pp. 801–813, fig. 1*).—In this paper formulas are derived for the calculation of the isoelectric point of complex ampholytes such as proteins, and the authors' conception of the isoelectric point and the mode of ionization of ampholytes is discussed briefly.

The isoelectric point of any amphoteric substance is considered to be "that H-ion concentration at which it is ionized equally as an acid and as a base." The derivation of the formulas given is based on the assumption that the ionization of each acidic or basic group in the molecule takes place independently of the degree of ionization of other groups in the molecule.

Some derivatives of cystin and cystein, G. J. SHIPLE and C. P. SHERWIN (*Jour. Biol. Chem., 55 (1923), No. 4, pp. 671–686*).—In connection with the investigation of the metabolism of cystin, the authors have prepared pure cystin and cystein and a number of derivatives of each. The methods of preparation of these compounds are described and their important physical constants are listed, together with sufficient analytical data to identify the substance in question. The structural formulas are also given. Of the compounds described, the following are said not to have been prepared before: Diphenylacetyl cystin, phenylacetyl benzyl cystein, phenyluramino benzyl cystein, benzyl cystein phenylhydantoin, *p*-chlorobenzyl cystein, acetyl benzyl cystein, and phenyluramino cystein.

On the existence of an unidentified sulphur grouping in the protein molecule, I, II, L. J. HARRIS (*Roy. Soc. [London], Proc., Ser. B, 94 (1923), No. B 663, pp. 426–450*).—Two papers are presented.

I. *On the denaturation of proteins* (pp. 426–441).—This paper contains an historical review of the literature on various sulphur compounds obtained in the decomposition of proteins, followed by a report of an examination of certain reactions given by egg white and its products attributable to sulphur groupings other than cystin. Egg white was subjected to various treatments and the resulting substances tested with sodium nitroprussid.

Raw egg white in the natural condition, dried by evaporation in vacuo or as a thin film on filter paper, or crystallized gave no nitroprussid reaction. Positive tests were given by egg white coagulated by heat or by the addition of hydrochloric acid or excess of alcohol, or treated with dilute hydrochloric acid or sodium hydroxid and warmed to 40° C. Egg white raw, cooked, or chemically coagulated gave on treatment with pepsin and hydrochloric acid a digest which was highly reactive to sodium nitroprussid. On following the digestion in progressive steps, it was found that at first the active group was confined chiefly to metaprotein and the unchanged coagulum, but as the digestion proceeded the active group was present in successively simpler molecules. If kept under strictly anaerobic conditions the acid digestion mixture remained active for many months, but in the presence of air the reactivity disappeared in a few hours in acid solution and even more rapidly when the solution was made alkaline. Solutions rendered inactive by oxidation could be restored to activity by reduction with tin and hydrochloric acid and subsequent removal of the tin by hydrogen sulphid and the hydrogen sulphid by boiling.

Coagulated serum failed to give the nitroprussid reaction under conditions in which ovalbumin gave a strong reaction. "This appears to be of much importance because it correlates the presence in egg albumin of an unknown sulphur body reactive to nitroprussid with the occurrence of only a small fraction of the total sulphur in the cystin form. In serum albumin, on the contrary, most of the sulphur can be returned as cystin, and here the nitroprussid reaction is accordingly negative."

During the tryptic hydrolysis of egg albumin no reaction to nitroprussid could be obtained at any stage of the digestion. This is attributed to the prompt oxidation of the active group in the presence of alkali.

In attempts to separate the reactive substance, the addition of mercuric sulphate and of ferric chlorid gave inactive precipitates and filtrates. On the contrary the addition of phosphotungstic acid or of lead acetate and barium hydroxid led to the production of active precipitates and filtrates.

In discussing these results the terms denaturation, coagulation, and precipitation with reference to proteins are defined as follows: "For the transformation of the native into metaprotein or intermediate coagulation product, involving an irreversible reaction and the production of reactivity to nitroprussid, the term 'denaturation' may be reserved. The irreversible flocculation of the denaturated protein in an insoluble condition will be termed coagulation, whether the coagulum be produced by the action of heat on the already changed metaprotein or on the original unaltered native protein. When albumin or metaprotein is thrown out of its colloidal solution (as by the action of ammonium sulphate) and can by suitable means be again brought into solution without losing any of its original chemical nature, the change is best denoted by the term precipitation."

The production of the grouping reactive to nitroprussid is considered to be an essential feature of the denaturation of ovalbumin and certain other proteins. "It is suggested that the nitroprussid reaction, attributed by Arnold to cystein, may be due to the presence in the native protein of a thiopeptid or similar groupings, which by hydrolysis or keto→enol transformation would give rise to an active —SH in the resulting metaprotein molecule."

II. *On the estimation of cystein in certain proteins* (pp. 441–450).—This paper deals with the determination of cystin and noncystin sulphur in egg albumin and in serum albumin. The method for determining cystin in the hydrolysis mixtures of the proteins is gravimetric, depending upon the precipitation of cystin with mercuric sulphate, removal of tyrosin which may be present by washing the precipitate with 5 per cent sulphuric acid, decomposition of the mercuric precipitate with hydrogen sulphid, precipitation of the resulting cystein with copper hydroxid, and subsequent conversion of the cystein to cystin by oxidation in a stream of air. On determining the cystin content of the hydrolysis products of ovalbumin and serum albumin under identical conditions a yield of from 0.3 to 0.35 per cent of the dried ash-free protein was obtained for ovalbumin and of 2.6 per cent for serum albumin. These results are considered to prove that in serum albumin the greater part of the sulphur is combined as cystin and in ovalbumin in some form other than cystin.

The determination of the digestibility of protein, A. Friederich (*Chem. Ztg., 47 (1923), No. 37, pp. 265, 266, figs. 2*).—The method described depends upon the principle that on digestion insoluble proteins become soluble, and that the duration and extent of this change can be measured by testing aliquots of the digestion mixture at regular intervals in an interferometer. The test consists in placing a 2.5 gm. sample of the protein material in a 250 cc. flask with from 150 to 200 cc. of water and 10 cc. of hydrochloric acid, and allowing it to stand in an incubator until there is no further change in the solubility as determined in the interferometer. About 0.5 gm. of pepsin dissolved in water is added to the digestion mixture, the flask filled to the mark with water at 37° C., the contents shaken well, and the flask again placed in the incubator. From time to time a small aliquot of the mixture is removed and tested in the interferometer.

Starch and starch products, H. A. Auden (*London and New York: Isaac Pitman & Sons, Ltd., 1922, pp. XIII+121, figs. 20*).—The sources, methods of preparation, and uses of the various common starches are discussed in nontechnical terms.

A revision of Rosanoff's diagram of the aldose sugars, J. J. Willaman and C. A. Morrow (*Jour. Amer. Chem. Soc., 45 (1923), No. 5, pp. 1273–1280, figs. 3*).—The authors have revised Rosanoff's diagram of the aldose sugars[1] to include all the sugars known at present, with additional facts concerning their properties. The diagram is reproduced and explained at length.

The iron content of lettuce, A. Lichtin (*Amer. Jour. Pharm., 95 (1923), No. 3, pp. 154–159, figs. 5*).—Data are reported on the iron content of five varieties of lettuce as determined by the colorimetrice thiocyanate method checked by titration with potassium permanganate. The minimum, maximum, and average values obtained for the different varieties are as follows: Big Boston 0.0025, 0.00294, and 0.00272; Iceberg 0.00154, 0.00225, and 0.00189; Cos 0.00031, 0.00035, and 0.00033; Grand Rapids 0.00299, 0.00304, and 0.00301; and May King 0.00254, 0.00399, and 0.00326 per cent, respectively.

The relation of H-ion concentration to the flocculation of a colloidal clay, R. Bradfield (*Jour. Amer. Chem. Soc., 45 (1923), No. 5, pp. 1243–1250, fig. 1*).—This investigation, reported from the Missouri Experiment Station, includes determinations of the minimum electrolyte requirement for the flocculation of a colloidal clay solution with (1) certain acids such as hydrochloric, sulphuric, phosphoric, acetic, and citric; (2) mixtures of potassium chlorid, potassium hydroxid, and hydrochloric acid combined in proportions to

[1] Jour. Amer. Chem. Soc., 28 (1906), No. 1, pp. 114–121.

give a constant potassium content and pH values from 4 to 12; and (3) mixtures of dipotassium phosphate, potassium hydroxid, potassium chlorid, and hydrochloric acid in which the potassium and phosphate contents were kept constant and the pH values varied from 4 to 12.

The colloidal clay used in these experiments was extracted from the subsoil of the Putnam silt loam by agitating 1 part of the fresh subsoil with 5 parts of distilled water for 3 hours in a churn of the barrel type. The suspension was allowed to stand for 10 days, during which time the coarser particles settled out. The material remaining in suspension was siphoned off and passed through a Sharples supercentrifuge making 32,500 r. p. m., at the rate of 1 liter per minute, and passed through the centrifuge a second time at the rate of 250 cc. per minute. The soil solution as thus prepared was rather viscous, of a clear dark amber color, and truly colloidal as shown by the fact that no particles could be detected in the oil immersion microscope. The solution was decidedly acid, having a pH value of about 5.8. When needed for the various determinations, it was diluted to the desired concentration, mixed rapidly with the electrolyte in a special apparatus, poured quickly into a 100 cc. test tube, and allowed to stand undisturbed at room temperature for 24 hours, when observations were taken. After the minimum concentration had been determined at least twice, the H-ion concentration of the supernatant liquid was measured electrometrically and its conductivity determined.

Hydrochloric, sulphuric, phosphoric, and acetic acids flocculated the colloidal clay at about the same H-ion concentration, but greater acidity was required with citric acid. A change in flocculating power with change in H-ion concentration was shown in the case of mixtures of potassium chlorid and hydroxid and also with dipotassium phosphate. In the former, a change in H-ion concentration of from pH 6.2 to 8 increased the electrolytic requirement 10 times, but further increases in alkalinity were without effect. "The phosphate curves differ, however, from the chlorid curves in three respects: (1) The break occurs in more acid mixtures, (2) the electrolyte requirement is higher, and (3) the curve shows a second minimum in alkaline mixtures. The results indicate that the flocculating power of potassium salts is influenced by the nature of the anion even when compared at the same Sörensen values. Secondary reactions seem to be responsible."

Apparatus for dispensing concentrated sulphuric acid and sodium hydroxid solutions, R. C. Abbott (*Indus. and Engin. Chem., 15 (1923), No. 5, p. 493, fig. 1*).—The apparatus described, which was devised at the Nebraska Experiment Station, consists of two 500-cc. burettes, graduated in 5 cc., which are supported at a convenient height above the laboratory table to allow the mouths of 800-cc. Kjeldahl flasks to be easily placed beneath them. Two 8-liter bottles for the acid and alkali, respectively, are placed on a stand between the burettes. Each is fitted with a 3-hole stopper which contains the long arm of a siphon tube, the short arm of which reaches to the zero mark on the burette, a bent glass tube for controlling the air pressure, and another bent-glass tube connected by means of rubber tubing to a two-way stopcock, which in turn is connected with some source of air pressure. When the bottles are filled the stoppers are kept in place by means of heavy wire to prevent their being forced out when pressure is applied. To fill one of the burettes the stopcock is closed properly, the tube controlling the atmospheric pressure is also closed with the thumb or forefinger, and pressure is applied through the other tube until the burette is filled. On releasing the thumb the excess liquid siphons back, leaving the burette filled to the zero mark.

A method for the determination of dissolved carbon dioxid, F. G. Hall (*Jour. Biol. Chem., 55 (1923), No. 4, pp. 751–755, fig. 1*).—The method described

depends upon the principle of vacuum extraction, which is thought to have certain advantages over other methods employed for the determination of dissolved gases. The apparatus for this determination consists of an evacuation tube constructed on the principles of the Van Slyke blood-gas apparatus, a measuring burette, and an absorption pipette. A diagram is given of the entire apparatus, and the technique of its use is described in detail.

Method of determining cyanamid, A. NANUSSI (*Gior. Chim. Indus. ed. Appl., 5 (1923), No. 4, p. 168*).—A method of determining cyanamid in calcium cyanamid is described as follows:

A 1-gm. sample of the finely divided calcium cyanamid is dissolved in 200 cc. of dilute nitric acid, the solution filtered and made slightly alkaline with dilute ammonia, and the cyanamid precipitated with an ammoniacal solution of silver nitrate. The precipitated silver cyanamid is filtered off, washed carefully, transferred with from 100 to 200 cc. of water to a liter Erlenmeyer flask, and treated with an excess of ammonium chlorid, after which a measured quantity of N/2 H_2SO_4 in excess of the requirement is added rapidly to avoid loss of ammonia. After 10 minutes, during which the flask is shaken occasionally, the excess sulphuric acid is titrated with N/2 NaOH, with methyl orange as indicator.

The detection of horse meat by biological reactions, E. CÉSARI (*Ann. Falsif., 16 (1923), No. 172–173, pp. 82–101*).—This is a general discussion of the value of various serological methods for detecting horse meat.

The analysis of margarin, G. D. ELSDON (*Chem. Age [London], 8 (1923), No. 202, pp. 450–452*).—Brief directions are given for the examination of margarins to determine the various oils and fats which have been used in their manufacture. The tests recommended include the Reichert-Meissl, Polenske, and Kirschner numbers from which the amount of butter and coconut oil present may be calculated, and the iodin value and refractive index from which, having determined the amount of butter fat and coconut oil, the values of the other oils may be obtained. Suggestions are given for methods of testing margarin for animal fats and for hydrogenated oil, the latter for the presence of nickel. In conclusion the author suggests the advisability of incorporating a reasonable amount of beef fat or butter fat into all margarins in order to supply the deficiency in vitamin A.

Sugar and molasses ash determinations, H. A. COOK (*Sugar [New York], 25 (1923), No. 5, pp. 231, 232*).—This is a discussion of the relative merits of the sulphated and carbonated ash determinations in sugar and molasses samples. Data are summarized on the comparative results obtained by the two methods with a large number of samples of cane sugar and with molasses. From the data on the sugars, the proper factor for converting sulphated to carbonated ash would seem to be 0.79 instead of 0.9 as originally adopted. It is pointed out, however, that it would be impossible to adopt a factor that would be absolutely accurate for all molasses on account of the difference in the mineral constituents of the ash. While 0.75 is considered the most suitable factor, it is thought advisable to determine a factor for each mill from the analyses of several samples.

It is recommended that for ash determinations in all sugar work the method of carbonate ash be adopted.

Adsorption by activated sugar charcoal, II, F. E. BARTELL and E. J. MILLER (*Jour. Amer. Chem. Soc., 45 (1923), No. 5, pp. 1106–1115*).—In continuation of the investigation previously noted (E. S. R., 48, p. 412), a study is reported of the adsorption of acid dyes by activated ash-free charcoal. The acid dyes used were the sodium and ammonium salts of picric acid and of eosin, the former in 0.005 and the latter in 0.0025 M concentration. Contrary to the

results obtained in the previous study in which the first adsorption of the basic dye left the solution neutral and becoming acid only after several successive adsorptions, with the acid dyes the greater amounts of alkali were set free on the first adsorption, while the amount set free diminished rapidly with successive additions of the solution and with the decrease in adsorption.

A further study of the relative adsorption of some of the more common organic and inorganic acids and inorganic bases by activated ash-free sugar charcoal indicated a marked selective adsorption for the various groups. The organic acids as a rule were adsorbed to a greater extent than the inorganic acids, while the inorganic hydroxids were not adsorbed at all.

The effect on adsorption of the substitution of hydroxyl and amino groups in the organic acids was also studied. The introduction of both decreased the adsorption of the acid to a greater or less extent, depending upon the nature of the acid into which it was introduced, the effect of the amino group being greater than that of the hydroxyl group. These results are compared with those of previous workers, and the theories which have been advanced in explanation are discussed.

In the authors' opinion the most logical explanation for the hydrolytic adsorption of electrolytes by charcoal is that "the charcoal selectively adsorbs the acid or base set free by hydrolysis of the electrolyte in aqueous solution, thus disturbing the equilibrium and causing further hydrolysis of the dissolved substance."

The decolorizing action of bone black, P. M. Horton (*Indus. and Engin. Chem., 15 (1923), No. 5, pp. 519, 520*).—This is a discussion, with illustrative analytical data, of the theory proposed by various investigators that the activity of bone char is due to its nitrogen content.

"In conclusion, it is suggested that bone char owes its power of removing color to the presence of active carbon, and that the nitrogenous material serves as a reserve to supply fresh carbon upon reignition. This will explain why the char can be renewed by ignition only as long as it contains nitrogenous material, and why the latter disappears with continued use. This does not preclude the possibility, however, that protein matter may have an important influence upon the form assumed by the carbon upon ignition. In general, it is assumed that the activity of a char from any source is due to the same form of amorphous carbon, produced by the low temperature decomposition of vegetable or animal substances. Usually, the carbon surface is coated over by a layer of ash or hydrocarbons. The surface may then be exposed, or the char activated, by removal of this film. In the case of sucrose or wood char this may be accomplished by selective oxidation; in the case of highly siliceous material such as rice-hull char the surface may be uncovered by boiling with sodium hydroxid; in the case of bone char the surface film is evidently soluble in water or dilute acids."

Production of sirup from sweet potatoes, H. C. Gore, H. C. Reese, and J. O. Reed (*U. S. Dept. Agr. Bul. 1158 (1923), pp. 34, figs. 14*).—This publication describes in detail the experimental methods developed by the Bureau of Chemistry for the manufacture of sweet potato sirup (E. S. R., 45, p. 416), and the extension of these methods to the production of the sirup on a commercial scale. The buildings and equipment for the manufacture both on an experimental and a commercial scale are described and illustrated by photographs and diagrams, and estimates are given of the cost of manufacturing the sirup in a plant having a capacity of 100 gal. per 10-hour day.

The method as developed is said to be simple, but to necessitate certain precautions to insure the production of sirup of fine quality. These include

the selection of washed potatoes free from decay, the use of pale distillers' malt in small amounts for converting the starch to sugar, and the use of ignited kieselguhr as a filter aid.

The equipment throughout should be arranged so that it can be cleaned readily. Once the operations are started the process should be completed without delay. The sirup if properly prepared is said to be clear, of an amber color, and a slight distinctive flavor and after taste. It is not so sweet as cane sirup or honey, but can be sweetened by the addition of 10 per cent of other sirups.

The chemical composition of the sirup is as follows: Solids 62.5 per cent, ash 1.02, protein (N×6.25) 1.03, reducing sugar as invert 21.77, reducing sugar as maltose 36.23, total sugar as invert 31.56, sucrose by polarization 9.4, sucrose by reduction 9.3, and dextrin 12.47 per cent. The dried sweet potato pomace had the following composition: Moisture 4.59, ash 4.46, either extract 4.3, protein 23.06, crude fiber 13.5, and nitrogen-free extract 50.09 per cent. This would indicate a high feed value of the pomace provided it could be dried economically. Various suggested uses for the sirup are as a table sirup, for cooking purposes, for the manufacture of colored and short-grain candies, and for blending with other sirup to prevent crystallization.

The commercial possibilities of the sirup are at present limited by the high cost of manufacture, which is estimated at 64.3 cts. per gallon exclusive of containers.

Horticultural products investigations (*Oregon Sta. Bien. Rpt. 1921–22, pp. 70, 71*).—In this brief progress report it is noted that in drying prunes temperatures as high as 180° F. with high humidity are injurious, products of better quality being obtained at temperatures of 150° with 20 per cent humidity. The drying time for prunes in the Oregon tunnel drier has been reduced from one-half to two-thirds, and the quality of the prunes has been much improved, by placing the fans in such a way as to induce artificial draft.

A study of proper conditions for canning broccoli without development of the condition known as flat sour has led to the conclusion that this vegetable must be cooked in the retort instead of under open bath conditions. It is recommended for both broccoli and cauliflower that the processing be carried on for 8 minutes at a minimum temperature of 236° in No. 2½ cans, with a fill of from 17 to 18 oz. Blackening of the tin in canned cauliflower was found to be due to the formation during processing of tin and iron sulphids by the action of hydrogen sulphid formed from the sulphur compounds present in the cauliflower.

Industrial uses of hydrogenated oils, W. W. Myddleton (*Chem. Age [London], 8 (1923), No. 202, pp. 448–450*).—This is essentially a discussion of the problems arising in the attempt to replace natural fats by hydrogenated oils in the preparation of various substances such as margarins, candles, and soap.

Furfural from corncobs.—I, Factors influencing the furfural yield in the steam-digestion process, F. B. LaForge (*Indus. and Engin. Chem., 15 (1923), No. 5, pp. 499–502, figs. 3*).—This paper reports an experimental investigation of the optimum conditions of operation in the method of making furfural from corncobs as previously described (E. S. R., 46, p. 710). The optimum conditions may be summarized as a temperature of about 180° C., a reaction period of about 2 hours, and a ratio of cobs to water of not greater than 1 : 4.

The dried-egg industry in China, B. C. Schmidt (*Northwest. Miller, 134 (1923), No. 8, pp. 817, 818, 838–840, figs. 8*).—This article, which is based on reports of the American consul general in Shanghai, China, describes

model egg-drying factory at Shanghai established and operated by an American organization. In conclusion, certain advantages in the use of dried eggs in place of shell eggs are outlined.

METEOROLOGY.

Report of the chief of the Weather Bureau, 1922 (*U. S. Dept. Agr., Weather Bur. Rpt. 1922, pp. 277, pls. 7*).—The work of the Weather Bureau during the year ended June 30, 1922, is reviewed and the general meteorological conditions and outstanding meteorological features of 1921 are given, including the usual detailed tables giving monthly and annual summaries of climatological data for the United States.

Outstanding features of the weather of the year covered by this report were excessive floods and persistent warmth. "The year ending June 30, 1922, will rank as a great flood year for the entire Mississippi River Basin and others immediately adjacent thereto." In all parts of the country, with the exception of portions of the Pacific States, the weather of 1921 averaged warmer than normal. "From the Plains States eastward, except in New England and close to the Middle and South Atlantic coast, the year was the warmest since State-wide averages were computed, about 30 years; and from Iowa eastward and southeastward to Ohio and Kentucky it was the warmest by 2° F. or more. The abnormally warm months over the greater part of the country were January, February, March, July, September, October, and December; but no month averaged cooler than normal over as much as three-fifths of the area of the country."

With the aid of a special Congressional appropriation of $9,000 the fruit frost service of the bureau was materially extended and improved during the year. "This service was of special value to citrus fruit growers in southern California, where the severest freeze in many years was experienced in January, resulting in enormous loss."

The orchard-spraying forecast service was continued with very satisfactory results in the apple-growing sections of northern New York and to a limited extent in certain localities in Pennsylvania, West Virginia, and Virginia.

Studies of the relation between weather and crops were continued, and some very close relations were established between the weather and yields of corn and oats in certain important producing areas. Investigations of this kind emphasize "the importance of the establishment of meteorological stations at agricultural experiment stations."

Monthly Weather Review (*U. S. Mo. Weather Rev., 51 (1923), Nos. 3, pp. 111–173, pls. 13, figs. 9; 4, pp. 175–237, pls. 10, figs. 23*).—In addition to detailed summaries of meteorological, climatological, and seismological data and weather conditions for March and April, 1923, and bibliographic information, reprints, reviews, abstracts, and minor notes, these numbers contain the following contributions:

No. 3.—The Wind Factor in Flight: An Analysis of One Year's Record of the Air Mail (illus.), by W. R. Gregg and J. P. Van Zandt; Wind Directions and the Orientation of Schoolhouses, by R. Nunn; Radio Reports Give Timely Notice of Rains in California, by G. H. Willson; Some Temperature and Humidity Relations of the Air, by W. J. Humphreys; Atmospheric Temperature and the Codling Moth (illus.), by C. C. Garrett (see p. 509); Three Wisconsin Snowstorms (illus.), by W. P. Stewart; Snowstorms of March 11–18, 1923, at Dubuque, Iowa, and Vicinity, by H. M. Wills; The Storms of March 11–12, 1923, in Illinois, by C. J. Root; Tornado in Tennessee on March 11, 1923, by

R. M. Williamson; and Climatological Data for Central America (illus.), by W. W. Reed

No. 4.—The Occurrence of Lightning Storms in Relation to Forest Fires in California (illus.), by S. B. Show and E. I. Kotok; Discussion of Thunderstorms and Forest Fires in California (illus.), by E. A. Beals; Forest Fire Weather in the Southern Appalachians (illus.), by E. F. McCarthy; Solar Radiation Intensities and Terrestrial Weather (illus.), by C. F. Marvin; Weather Forecasting from Ships at Sea, by A. J. Henry; Concerning the Accuracy of Free-air Pressure Maps (illus.), by C. L. Meisinger; and Cox on Thermal Belts and Fruit Growing in North Carolina (illus.), by A. J. Henry, abstracted from Supplement 19 (E. S. R., 49, pp. 314 and 337).

Meteorological summaries (*Kentucky Sta. Rpt. 1922, pt. 1, pp. 59–61*).—Tables compiled from the records of the U. S. Weather Bureau Station at Lexington, Ky., summarize data for temperature, precipitation, humidity, wind, and cloudiness, 1872–1922.

Air and soil temperatures (*Kentucky Sta. Rpt. 1922, pt. 1, pp. 57, 58*).—Average weekly temperatures of the air and soil (at depths of 3, 18, and 36 in.) on the station farm during 1922 are reported. Thermographs were relied upon for a continuous record, but were checked frequently with mercury thermometers. The soil thermographs were located for 44 weeks in a field of red clover, afterward in a plat of soil free from vegetation. Comparative fluctuations of the air and soil temperatures are discussed.

Meteorological observations at the Massachusetts Agricultural Experiment Station, J. E. Ostrander, G. E. Lindskog, and H. H. Shepard (*Massachusetts Sta. Met. Buls. 413–414 (1923), pp. 4 each*).—Summaries of observations at Amherst, Mass., on pressure, temperature, humidity, precipitation, wind, sunshine, cloudiness, and casual phenomena during May and June, 1923, are presented. The data are briefly discussed in general notes on the weather of each month.

Atmospheric temperature and the codling moth, C. C. Garrett (*U. S. Mo. Weather Rev., 51 (1923), No. 3, pp. 128, 129, pl. 1, fig. 1*).—This article describes briefly observations on temperature which have been carried on in the Yakima fruit district of Washington State during the last five seasons, with a view to giving warning of conditions favorable to the emergence of the codling moth and indicating the proper time for spraying, based upon studies by the Bureau of Entomology of the Department. It is stated that these observations "have played a large part in codling-moth control in this district."

Predicting drought in Europe, F. Eredia (*Elettrotecnia, 9 (1922), pp. 746–748; abs. in Sci. Abs., Sect. A—Phys., 26 (1923), No. 303, p. 119; U. S. Mo. Weather Rev., 51 (1923), No. 3, p. 142*).—The possibility of forecasting droughts some months in advance is discussed in this article. It is stated that previous attempts in this direction have not led to a practical solution of the problem.

The author reached the conclusion that barometric pressure is one of the controlling factors most likely to lead to practical results in this respect. From his study of droughts in Italy he concludes that periods of high pressure in the Alpine and adjoining regions coincide with dry periods; also that "in Italy, with persistent high pressure on the west coast of Europe, and especially on the French Atlantic seaboard, a shortage of rain is almost certain." Extending his studies to the British Isles, he reaches the conclusion that persistent low pressure in the Arctic regions, and especially over Spitzbergen, points to the probable imminence of a dry period.

SOILS—FERTILIZERS.

Farm fertility, S. B. HASKELL (*New York and London: Harper & Bros., 1923, pp. VIII+243+XVIII, pls. 4, figs. 23*).—This handbook, a number of the Harper Handbook Series, edited by W. C. O'Kane, contains practical information on soil fertility and soil management. Chapters are included on kinds of soil, moisture supply of the plant, plant food, life in the soil, organic matter, tillage, rotation, and fertility, green manures and cover crops, animal manures, carriers of food, purchase and use of commercial fertilizers, limes and liming, waste of plant food, and fertility problems in extensive and intensive agriculture.

Soil fertility investigations [at the Oregon Station] (*Oregon Sta. Bien. Rpt. 1921–22, pp. 50–57*).—Data are summarized on fertility rotations, phosphorus, sulphur, potash, and nitrogen studies, and on the drainage and improvement of soils. Data are also briefly presented on the relation of sulphur to soil fertility anl plant composition.

The phosphorus studies showed that acid phosphate alone and in combination with barnyard manure gave larger crop increases than rock phosphate alone or rock phosphate and manure. Lime did not aid in making rock phosphate more available, but organic matter and sulphur did. Rock phosphate gave the largest increases in soluble phosphates when composted with sulphur and manure. The sulphur studies indicated that about 100,000 acres of alfalfa land in Oregon can be increased in annual yield by at least a ton of alfalfa per acre, if 100 lbs. of sulphur is applied once in four years.

[Fertility, rotation, and irrigation experiments in Oregon] (*Oregon Sta. Bien. Rpt. 1921–22, pp. 84–86*).—General data from studies at the Umatilla Substation on rotation, percolation, and irrigation are summarized.

Crop rotation and soil fertility, W. L. POWERS and C. V. RUZEK (*Oregon Sta. Circ. 44 (1923), pp. 3–12, fig. 1*).—Practical information on the relation between crop rotation and soil fertility, with particular reference to conditions in Oregon, is presented.

[Soil fertility studies at the Rhode Island Station] (*Rhode Island Sta. Bul. 193 (1923), pp. 5–8*).—The progress results of studies on the use of green manures and stable manure as organic matter for the soil and of general fertilizer studies to determine the best sources of the important fertility constituents for different crops on the soils at the station are briefly presented.

The influence of rotation upon the maintenance of soil fertility (*South Dakota Sta. Rpt. 1922, pp. 11, 12*).—It is stated that all plats in this study which have received applications of phosphorus either alone or in combination with nitrogen or potassium or both have produced increased yields over the check plats. This is taken to indicate that phosphorus is the limiting element in the soil of the plats.

A comprehensive geology, A. W. GRABAU (*Boston: D. C. Heath & Co., 1920, pt. 1, pp. XVIII+864, pl. 1, figs. 784; 1921, pt. 2, pp. VIII—876, pl. 1, figs. 1245*).—This work is in two volumes. Volume 1 deals with general geology and volume 2 with historical geology. Numerous chapters are included which should be of importance in the study of soils.

Weight of sedimentary rocks per unit volume, A. C. LANE (*Bul. Geol. Soc. Amer., 33 (1922), No. 2, pp. 353–362, fig. 1; also Tufts Col. Studies, 5 (1922), No. 3, pp. 353–362, fig. 1*).—Studies are reported which showed that the mean weight of wet sedimentary rock probably varies from less than 2,000 oz. per cubic foot upward as the water is squeezed out. It is thought that glacial brick clays may serve as a good average. Weighing a sample with its natural moisture, then dipping in paraffin and weighing again and when im-

mersed in water is considered to be a rapid method of making tests, which agrees with other methods.

Soil survey of Adams County, Ind., G. B. JONES ET AL. (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1921, pp. III+20, fig. 1, map 1*).—This survey, made in cooperation with the Indiana Experiment Station and the Indiana Department of Geology, deals with the soils of an area of 215,680 acres in northeastern Indiana. The topography varies from level to rolling. Practically all of the area is said to be tillable with the exception of steep slopes in the more rolling country and the narrow strips of overflowed land along the smaller streams. Tile drains and open ditches are said to have been installed extensively and supplement the natural drainage in the more poorly drained sections of the county.

The soils are mainly of glacial origin, and consist of an unassorted mixture of silt, sand, clay, and gravel varying in depth from 10 to 100 ft. or more. This material is weathered to an average depth of from 24 to 30 in., and in general consists of a silty clay loam to silty clay. The till is said to be highly calcareous below the weathered layer. Including muck and peat, 7 soil types of 5 series are mapped, of which the Miami, Brookston, and Crosby silty clay loams cover 42.7, 32.1, and 19.4 per cent of the area, respectively.

The pasture soils of Vaud and Neuchâtel of upper Jura, their flora and fertilizers, C. DUSSERRE (*Ann. Agr. Suisse, 23 (1922), No. 4, pp. 275–294, figs. 2*).—The results of a survey of an area of 48,010 hectares (118,585 acres) of pasture soils in the upland regions of the cantons of Vaud and Neuchâtel in Switzerland are presented, including physical, mechanical, and chemical analyses of the prevailing soil types, a description of the vegetation, and a discussion of soil fertility and fertility requirements and practices.

The mechanical and physical analyses indicate that the surface soils are generally fine grained. They contain very little colloidal clay, and fine sand predominates, rendering the soils light and pervious. These soils are said to be richer in humus than corresponding plain soils, and due to this and the absence of lime most of them are acid. The chemical analyses indicate that the total nitrogen content is proportional to the content of organic matter. A considerable reserve of nitrogen is apparently held in the humus content. While these soils have a fair average content of total phosphoric acid, it is said to be only slightly soluble. They are said to carry a considerable reserve of potash.

Biochemical studies of forest soils, A. NĚMEC and K. KAREL (*Compt. Rend. Acad. Sci. [Paris], 176 (1923), No. 4, pp. 260–262*).—The results of more than 120 different biochemical studies of forest soils from Czechoslovakia are briefly summarized.

These are taken to indicate that the active acidity of a forest soil varies markedly under the influence of different species and forms of its vegetation and soil organisms. In general, it is concluded that the humus from the leaves of very old trees has a less active acidity than that from ordinary leaves in the same neighborhood. This relation is said to be also exhibited in determinations of the so-called exchange acidity. Soils carrying a mixture of different species of leaves and of conifer products are said to be less acid than those carrying one species of leaves or needles. The acidity of humus and mineral soils under a single species of leaf is said to vary with the nature of the soil itself.

Influence of tropical climate on the soils of Surinam, J. E. VAN AMSTEL (*Landbouwk. Tijdschr. Suriname en Curaçao, 6 (1921), No. 2, pp. 20–24*).—It is pointed out that the excessively humid climate of Surinam results in rapid leaching out of the soils and the formation of soils of more or less lateritic

nature. Plant remains and other organic matter are quickly humified and mineralized in these soils, and the unweathered mineral constituents are quickly decomposed. Treatment with materials to add organic matter to the soils, together with proper cultivation, is recommended for these soils.

Observations relative to the influence of pulverization and settling of soil on its humidity, A. PETIT (*Ann. Sci. Agron. Franç. et Étrangère, 39 (1922), No. 3, pp. 170–176*).—Studies on the influence of pulverization and settlement of soil on capillarity and absorption of moisture are reported.

The finer the pulverization the greater was the capillary rise of moisture in soil. This rise underwent a sudden and large increase for sieved soils of less than 1 mm. in diameter. Soils not sieved showed a capillary rise somewhat similar to sieved soils of from 1 to 2 mm. in diameter. Settling of pulverized soils of less than 1 mm. in size appeared to hinder the capillary movement of moisture. On the other hand, with soils of larger sized grains settling seemed to favor the capillary movement of moisture. This influence was more marked as the size of grains increased.

It was further found that, with long columns of soil, settlement accelerated capillary rise of moisture, and that this rise increased with time.

Studies on the influence of pulverization and settlement on the absorptive power of soils for moisture showed that size of aggregate apparently had no influence on absorptive power when the grains were greater than 2 mm. in size, but that when less than 2 mm. the capacity of the soil for water increased rapidly with the degree of pulverization. Settlement of pulverized soil considerably reduced its capacity for water.

Acid soils of lower Seine country [France]: A study on the comparative uses of lime and ground chalk for the correction of acidity, C. BRIOUX (*Ann. Sci. Agron. Franç. et Étrangère, 39 (1922), No. 3, pp. 129–155, pls. 2*).—The acid soils of the lower Seine country are briefly described, different methods of determining soil acidity are discussed, and the results of comparative studies of lime and ground marl or chalk are briefly presented. Analyses of several samples of the chalks and marls from the lower Seine country are also presented and discussed. The calcium carbonate content in 20 samples was found to vary from 92.4 to 98.4 per cent.

Studies of the solubility of ground chalk in water charged with carbon dioxid showed that when ground fine enough to pass a No. 60 sieve its solubility was very high. It is concluded that the chemical activity of the calcium carbonate of chalk in soil is directly proportional to its degree of fineness and inversely proportional to its hardness.

Studies of the influence of lime and ground chalk on the nitrification of ammonium sulphate in acid soil showed that the amount of nitrate formed was proportional to the fineness of the chalk, and that chalk fine enough to pass a No. 60 sieve gave as good results in this respect as lime. Further studies on different acid soils with different crops showed that finely pulverized chalk is as active chemically as lime when used in amounts supplying equivalent amounts of calcium oxid.

The grinding of marl and limestone is also briefly discussed, and a bibliography is appended.

Modification of sour soils (*Rhode Island Sta. Bul. 193 (1923), pp. 13, 14*).—The progress results of studies of the effect of different kinds of lime on sour soils at the station are briefly presented. These showed that hydrated calcic and magnesic limes maintained the soil in a neutral condition, while with the corresponding limestones the soil was slightly acid. It was noted that crops having a low lime requirement were either not benefited or were slightly injured by liming.

Soil reaction and its application in agronomy, A. DEMOLON (*Ann. Sci. Agron. Franç. et Étrangère, 6. ser., 37 (1920), No. 2, pp. 97–114*).—A review is given of available information on the nature of soil acidity, methods for its determination, and its practical agronomic significance, with particular reference to cultural practices. It is concluded that while soil reaction is a purely scientific consideration it is of real agronomic interest. A bibliography of 44 references to literature bearing on the subject is appended.

Alkali [studies at the New Mexico Station] (*New Mexico Sta. Rpt. 1922, p. 31*).—Data from these studies are said to have shown that soils containing 1 per cent of white alkali and 1 per cent of plant nutrients tend to become impermeable when leached with water free from minerals, and that both alkali and soluble plant nutrients accompany the water in its percolation. An application of 6 in. of water where it penetrates a foot of soil has been found to remove almost as much alkali and plant nutrients as 72 in. of water. Only a relatively small amount of water apparently is needed to leach the white alkali below the toxic limit, and the same amount of water removed soluble plant nutrients to the same extent, except soluble phosphoric acid. These results are taken to indicate that permeability and drainage are the most important factors in the leaching out of white alkali.

The vertical movement of alkali under irrigation in heavy clay soils, F. T. SHUTT and A. H. ATACK (*Roy. Soc. Canada Proc. and Trans., 3. ser., 16 (1922), Sect. III, pp. 227–232*).—This report is a continuation of studies on the vertical movement of alkali under irrigation in heavy clay soils previously noted (E. S. R., 48, p. 422). The conclusion is again drawn that irrigation under the conditions of the experiment has not caused any appreciable rise of alkali. Notwithstanding the existence of a close, almost impervious subsoil, strongly impregnated with alkali, it is considered possible that an area of heavy clay may be safely irrigated for a number of years provided the irrigation is judicious (say approximately 1.5 ft. annually), that at the outset the surface soil to a depth of 1.5 ft. is free from alkali, and that provision is made for the removal of surplus water by surface drains and ditches.

The "alkali" content of soils as related to crop growth, F. T. SHUTT and A. H. ATACK (*Roy. Soc. Canada Proc. and Trans., 3. ser., 16 (1922), Sect. III, pp. 233–240*).—This is the fourth report of studies begun in 1918 (E. S. R., 46, p. 512), in which additional information on the character of the alkali found is presented, together with an attempt to correlate and interpret the results of this and previous years' work, with special reference to wheat.

It is considered apparent that for wheat the limit of sodium sulphate in the chief root-feeding zone is between 0.5 and 1 per cent, and for sodium carbonate from 0.06 to 0.07 per cent. Western rye grass appeared to be a comparatively nonresistant crop, 0.2 per cent of sodium sulphate being apparently the toxic limit. Native prairie grass seemed to be somewhat more resistant than wheat, the toxic limit of sodium sulphate not being reached until there was 1 per cent in the root-feeding zone. The limit of sodium sulphate for oats appeared to be from 0.9 to 1 per cent and of sodium carbonate approximately 0.2 per cent. The limit of sodium carbonate for onions was evidently about 0.2 per cent. Apparently timothy was slightly less resistant than wheat, the limit of tolerance toward sodium sulphate being about 0.7 per cent. The toxic limit of sodium carbonate for vetch and rye appeared to be about 0.2 per cent. Of all the series examined, magnesium sulphate seemed to occur only in places where sodium sulphate had already reached and exceeded a toxic amount.

A peculiar soil condition in the San Luis Valley, W. P. HEADDEN (*Colorado Sta. Bul. 286 (1923), pp. 3–15, figs. 3*).—A description is presented of a

soil condition in the San Luis Valley in Colorado in which, in the presence of sodium carbonate, the soils became hard, and gypsum failed to counteract this condition. Plant roots were not only short but badly distorted, and the soil when removed and packed in a sack became very hard. The amount of sodium carbonate found on analysis was only about one-fourth of the minimum found to be injurious to plants. The only data so far available are taken to indicate that the addition of an amount of sodium carbonate no greater than that found in this soil may produce a considerable degree of caking. The tentative opinion is advanced that the caking may be due to the presence of hydrated silicic acid, which may on exposure to air and drying serve to cement the soil particles together.

It is also intimated that the alkaline water of this area owes its existence to the lack of drainage and its character to concentration by evaporation and the elimination of silicic acid, lime, and magnesium salts. It is further stated that if silicic acid is the cause of the hardening of the soil it will explain the failure of gypsum to ameliorate the condition.

[Soil blowing prevention experiments at the New Mexico Station] (*New Mexico Sta. Rpt. 1922, pp. 6, 7*).—It is stated that fall plowing has a small advantage of yield over spring plowing as an average of a series of years but is more liable to blow, and that planting with a lister without previous cultivation has proved distinctly inferior to plowing and surface planting. Fallow has been found difficult to keep from blowing and does not increase yields over safer methods enough to warrant its general use. Green manure has not increased yields over those on land from which a crop is harvested.

[Soil biological studies at the Oregon Station] (*Oregon Sta. Bien. Rpt. 1921–22, pp. 59–61*).—Studies of the effect of lime on the biological activities in acid soils showed that under greenhouse conditions the biological processes in free acid soils are stimulated when lime is applied. The nitrifying power especially was increased in all the soils studied. Studies of the H-ion concentration of these soils showed that wherever the crop-producing power of the soil is depressed by the application of lime the pH value is 7 or greater.

Studies on sulphur oxidation in samples of soil representing the irrigated Columbia Basin, irrigated soils of southern and central Oregon, and two prominent Willamette Valley soil types, showed that the samples tested can oxidize sulphur as rapidly as would be required for maximum crop production, although a wide variation exists in their comparative sulphur-oxidizing powers. No apparent relation was established between the total sulphur content and the sulphur-oxidizing power of the soil. The application of sulphur made the soil a more favorable medium for the growth of sulphur-oxidizing organisms. Inoculated sulphur stimulated sulphur oxidation, but for the soils studied there was no indication that such inoculated sulphur was more valuable for general field application than ordinary commercial sulphur. The temperature and moisture of the soil seemed to be the important factors affecting the rate of sulphur oxidation, although sulphur oxidation was very strong even in air-dry soils.

Soil microorganisms in their relation to crop growth, E. J. Russell (*Ann. Sci. Agron. Franç. et Étrangère, 6. ser., 38 (1921), No. 2, pp. 49–67, figs. 2*).—A brief review is presented of the status of studies at the Rothamsted Experimental Station on soil microorganisms, with particular reference to their influence on soil fertility and crop growth.

The studies have indicated, in general, that the activities of soil bacteria are necessary to the growth of crops in field tests, but that the soil organism population is varied and the relations between groups of organisms and between organisms and crops quite complex. The studies have further indicated

that the protozoa form a normal part of the soil population, and that during active life they limit the numbers of soil bacteria.

The results of other studies are said to have indicated, indirectly at least, that the fungi, especially the Actinomyces, are quite active in the decomposition of cellulose in soils. Soil algae have also been found to assume considerable importance, especially in infertile or untreated soils. The significance of partial sterilization of soils is also discussed briefly, with particular reference to its influence on soil fertility.

Soil protozoa, M. PEREY (*Ann. Sci. Agron. Franç. et Étrangère, 39 (1922), No. 6, pp. 333–352, figs. 8*).—This is a description of the methods of study of soil protozoa used at the Rothamsted Experimental Station and a summary of the more important investigations and findings, with particular reference to prevailing forms and numbers of soil protozoa and the relations of protozoa to soil bacteria and soil fertility.

Partial sterilization of soil by means of sodium arsenate, G. RIVIÈRE and G. PICHARD (*Ann. Sci. Agron. Franç. et Étrangère, 39 (1922), No. 6, pp. 366–370*).—Experiments with wheat, oats, and potatoes are described, the results of which are taken to indicate that, while sodium arsenate used in low concentrations has no directly favorable influence on the major crops, its toxicity is sufficient to kill the soil protozoa and thus produce the indirect fertilizing action of partial sterilization.

The absorbent power of soils for ammonia, A. PETIT (*Ann. Sci. Agron. Franç. et Étrangère, 6. ser., 38 (1921), No. 1, pp. 20–35*).—Studies on the absorbent power of heath soil and raw kaolin for ammonia are reported.

These showed that heath soil gives up its ammonia easily to water, and that this removal is favored by the presence of such fertilizer salts as potassium sulphate, potassium chlorid, and sodium nitrate. However, both kaolin and heath soils having an acid reaction were able to fix ammonia combined with sulphuric acid. This power was masked in heath soils somewhat by the giving up of ammonia to water. Treatment with hydrochloric acid did not increase the absorbent power of either soil for ammonia. The addition of lime only slightly increased the absorbent power of heath soil for ammonium sulphate and did not increase that of kaolin at all. It apparently destroyed the absorbent power of both soils for free ammonia. When a soil did not give up ammonia to water, a dilute saline ammoniacal solution was more impoverished by its absorbent power than was a concentrated solution. The ammonia fraction absorbed decreased when the volume of the saline solution used increased, and increased as the weight of soil used increased.

The relation of concentration of soil solution to nitric nitrogen in soils containing large quantities of available nitrogen, and their effect upon plant growth (*New Mexico Sta. Rpt. 1922, pp. 39, 40*).—Further progress results obtained in this project (E. S. R., p. 417) are briefly presented.

On the use of calcium carbonate in nitrogen fixation experiments, P. L. GAINEY (*Jour. Agr. Research [U. S.] 24 (1923), No. 2, pp. 185–190*).—Experiments conducted at the Kansas Experiment Station in which the relative growths of Azotobacter from a large number of different soils were compared to observe the effects of calcium carbonate on nitrogen fixation are briefly reported.

The results showed that the quantity of nitrogen fixed in the presence of Azotobacter was greater than when it failed to develop. The number of soils capable of initiating the growth of Azotobacter under the experimental conditions was greater by 20 per cent when calcium carbonate was added to the medium than when it was omitted. The quantity of nitrogen fixed in a medium containing calcium carbonate was for all practical purposes always

equal to and in most cases greater than when calcium carbonate was not present in the medium. The presence of calcium carbonate exerted a greater beneficial effect upon those organisms other than Azotobacter which brought about nitrogen fixation than upon Azotobacter itself.

Pot cultures with barley in soil from a long-time fertilizer experiment, A. R. C. Haas (*Bot. Gaz., 75 (1923), No. 1, pp. 95–102, figs. 4*).—In a contribution from the University of California and the California Citrus Experiment Station, the results of barley culture studies in soil taken from different plats of a long-time fertilizer experiment on citrus soil are presented.

These showed the lack of agreement between the barley-producing power of soils and the yield and condition of citrus on such soils at the time the samples were taken. Moreover, it apparently could not be concluded that the amount of nitrogen previously added to a soil is an accurate measure of its barley-producing power. The addition of phosphoric acid or potash to the soils studied did not show any added advantages for the growth of barley or of citrus.

[**Fertilizer studies at the Georgia Station**] (*Georgia Sta. Rpt. 1922, p. 9*).—Composting mixtures of cottonseed meal, phosphate rock, soil, and manure for six months under laboratory conditions is said to have resulted in losses of total nitrogen ranging from 50 to 70 per cent. In one case only the loss of dry matter reached a maximum of 15 per cent. The addition of two parts of sulphur per hundred reduced the nitrogen loss to practically nothing, while the loss in dry matter was not noticeably affected. Only slight increases in available phosphorus were found by analysis after six months of the composting treatment. It was apparently not affected by the small amount of sulphur added.

[**Soil studies at the Kentucky Station**] (*Kentucky Sta. Rpt. 1922, pt. 1, pp. 30–35*).—Data from different experimental fields are briefly presented to show the difference in behavior of acid phosphate and rock phosphate on limed and unlimed soils of different types (E. S. R., 48, p. 116). In one case the rock phosphate was as effective as acid phosphate on both limed and unlimed soil, while in another case the other extreme was found in that rock phosphate was very effective on unlimed soil and very ineffective on limed soil. Where it existed at all the depressing effect of limestone on rock phosphate increased with time.

Studies of the rendering available of potash in insoluble silicates by the action of soil bacteria and on sulphur in plants and soils are also briefly noted.

[**Soil and fertilizer experiments**] (*Assam Agr. Expts. and Demon. Rpt., 1922, pp. 24–33*).—The results of a lime and manurial experiment begun in 1911 at the Jorhat Experiment Station to determine whether lime is best added in large occasional applications or in more frequent smaller applications are briefly reported. These showed that during the first few years of the experiment the biggest crops were returned where the larger and less frequent applications were made. By about the fifth year the smaller and more frequent applications were returning the larger yields.

The results of an experiment begun in 1911 are taken to indicate conclusively that a vast improvement in cropping may result from the intelligent use of wood ashes with cow manure.

An experiment conducted for 10 years to determine the function of lime in soil and with various manures and mixtures thereof is said to have shown clearly that the application of any base, either lime, magnesium carbonate, or even sodium carbonate, sufficed to produce a crop of oats in cold weather, and that the prime requirement of the soil used was for a base of some sort. How-

ever, the later results of the experiments indicate the advantage of the use of lime.

An excessive lime application produced chlorosis in the cowpea crop during the first year or two after application, but it did not appear to affect adversely other crops. Ammonium sulphate as a source of nitrogen acted adversely on crops in the absence of lime, and those soils receiving an annual dressing became more and more toxic. It was only in the tenth year of the experiment that the sulphate or nitrate of potassium used alone, even in the presence of lime, showed any marked effect on crops. The results of ground limestone and mineral phosphate experiments are also briefly reported.

Fertilizer action and time of fertilizer application, T. REMY (*Deut. Obst-u. Gemüsebau-Ztg., 69 (1923), No. 8, pp. 57, 58*).—In studies with oats and bush beans conducted at the Institute for Soil and Plant Culture, Bonn, it was found that the time of application of nitrogenous and potassic fertilizers had relatively little influence on their effectiveness on the crops used. There was a slight tendency for their effectiveness to decrease with lateness of application. This tendency was quite marked with phosphatic fertilizers and their assimilation. It is concluded that the application of fertilizers at the right time is an important consideration, with special reference to phosphatic fertilizers.

Goat manure (*New Mexico Sta. Rpt. 1922, p. 32*).—Experiments on the use of goat manure are said to have shown that cabbage on goat manured soil suffered severe injury during the first six weeks, improving somewhat later but never maturing any number of good heads. The same soil treated with horse manure did not show signs of injury and produced a normal crop.

Analyses of the goat manure showed that the salt content is not sufficient to make the first foot of soil toxic when the manure is applied at the rate of 25 tons per acre. It is not considered reasonable to assume that goat manure contains undiscovered toxic materials not found in other manures. It is thought that the difficulty may lie in an apparent deficiency in nitrogen.

Alfalfa fertilizers (*New Mexico Sta. Rpt. 1922, pp. 45, 46–48, figs. 3*).—Tabular and graphic data are presented describing studies on fertilizers and fertilizer practices in the raising of alfalfa.

Industrial transformation of ammonia into urea, a fertilizer of high concentration, C. MATIGNON and M. FRÉJACQUES (*Chim. et Indus. [Paris], 7 (1922), No. 6, pp. 1057–1070, figs. 4*).—This article deals largely with the chemical and industrial aspects of the process of transforming ammonia into urea for use as a fertilizer.

Neutral phosphate: A result of recent efforts of the phosphate fertilizer industry, F. KANHÄUSER (*Chem. Ztg., 47 (1923), No. 17, pp. 121–123*).—A brief review is given of the phosphate fertilizer situation in Germany, and so-called neutral phosphate is described. This material is a result of the acid treatment of either raw phosphate or bone meal, or a mixture of the two. It is said to contain from 20 to 25 per cent of total phosphoric acid.

Laboratory and field experiments with different crops are briefly reviewed, indicating that the phosphoric acid in neutral phosphate showed the same physiological action as that in superphosphate, especially on winter wheat, barley, sugar beets, and potatoes. It is concluded that the overestimation of the availability of phosphoric acid in superphosphate is unwarranted.

The potash beds of Alsace, C. MATIGNON and F. MEYER (*Rev. Écon. Internatl., 14 (1922), IV, No. 2, pp. 319–344*).—This article describes the place of chemical fertilizers in industry and the uses of potash in agriculture. Attention is drawn to the world sources of potash, both primary and secondary, with particular reference to the Alsatian mines. The technical opera-

tion and development of these mines are discussed, with particular reference to the economic factors involved.

Relations between calcium carbonate, certain fertilizer chemicals, and the soil solution, F. W. MORSE (*Soil Sci., 15 (1923), No. 2, pp. 75–92*).—Studies conducted at the Massachusetts Experiment Station on the relation of the fundamental laws of solutions to the use of lime in agriculture are reported, together with the results of studies obtained with different fertilizers in field experiments.

It was found that when solid calcium carbonate exists in the soils in contact with the soil solution, the concentration of calcium carbonate in the solution is dependent upon the amount of carbon dioxid in the soil air. It is independent of the amount of calcium carbonate in reserve.

When chemical fertilizers were used in addition to calcium carbonate the application of calcium phosphates, calcium sulphate, and ammonium sulphate lowered the concentration of calcium carbonate in the soil solution and lessened its alkalinity. The addition of sodium nitrate and potassium chlorid increased the concentration of the calcium carbonate and the alkalinity of the solution. Soil extracts obtained from limed field plats gave results in accordance with these principles.

The extracts obtained from unlimed soils showed little effect of superphosphate and potassium chlorid on the pH value. The addition of ammonium sulphate produced low pH values, as though sulphates of aluminum and iron were present. Sodium nitrate when added caused the extracts to behave as though calcium bicarbonate were present.

The toxicity of lime to Fomes lignosus, G. BRYCE (*Ceylon Dept. Agr. Bul. 64 (1923), pp. 17*).—Experiments are reported the results of which are taken to indicate that *F. lignosus* mycelium is capable of growing on alkaline media up to —66 on Fuller's scale. It is very sensitive to acid media, growing with difficulty at +8 Fuller's scale, and undergoing total inhibition at +16. It is affected by slaked lime, but total inhibition did not occur until a concentration of 1.3 per cent by weight of slaked lime was reached. Calcium carbonate had no effect on the fungus. In view of recent soil studies which demonstrated that quicklime if applied to the soil is rapidly converted to carbonate, it is concluded that soil applications of burnt lime are of little fungicidal value for *F. lignosus*.

Utilization of cachaza, S. F. MORSE (*Facts About Sugar, 16 (1923), No. 17, pp. 334, 335*).—Practical information is presented on the value of cachaza for use in increasing the fertility of run-down soils. Data are presented from Cuba, Porto Rico, and Hawaii showing the content of plant nutrients of cachaza. The opinion is expressed that this material will not give profitable results on rich land, but that it should be applied to so-called bad spots, naturally poor soils, and lands which have been depleted by continuous cropping.

Report on commercial fertilizers in 1919, C. O. SWANSON, W. L. LATSHAW, L. E. CALL, and R. I. THROCKMORTON (*Kansas Sta. Insp. Circ. 12 (1920), pp. 43, figs. 3*).—Part 1 of this circular contains actual analyses and guaranties of 109 samples of fertilizers and fertilizer materials collected for inspection in Kansas during 1919, and in addition presents the chief provisions of the Kansas fertilizer law, data on the sale and prices of fertilizers in Kansas, and a list of brands of fertilizers registered for sale in Kansas during 1919 and of Kansas dealers in fertilizers. Part 2 presents practical information on the use of commercial fertilizers in the State.

AGRICULTURAL BOTANY.

Photosynthesis and the electronic theory, II, H. H. Dixon and N. G. Ball (*Roy. Dublin Soc. Sci. Proc., n. ser., 16 (1922), No. 30–34, pp. 435–441*).—Previous experiments (E. S. R., 45, p. 821) having shown that the number of electrons ejected from the molecules of chlorophyll when illuminated by visible light could not carry anything like sufficient energy to make the formation of the observed quantities of carbohydrates possible external to the chlorophyll, it would seem to follow that the necessary electrons are not ejected from the chlorophyll molecule but are merely displaced. This displacement may be supposed to render some atomic group in the chlorophyll molecule reactive, leading to the fixation of carbon dioxid, to the separation of a carbohydrate from its complex molecule, and to reconstitution of the original from the residue and water, with the evolution of oxygen.

This paper contains an account of some experiments carried out with a view to testing further and from different angles the photo-electric properties of chlorophyll by means of a photographic method.

Nutrition of plants considered as an electrical phenomenon, J. F. Breazeale (*Jour. Agr. Research [U. S.], 24 (1923), No. 1, pp. 41–54, figs. 5*).—From a study of seedlings of wheat, corn, and kafir grown in distilled water or nutrient solutions containing nitrogen, phosphoric acid, and potash as sodium nitrate, sodium phosphate, and potassium chlorid, the author concludes that plants probably feed upon ions and these ions probably penetrate the root membrane and move through the colloids to the tissues as an electrical charge.

On the physiological balance in nutrient solutions for plant cultures, W. F. Gericke (*Amer. Jour. Bot., 9 (1922), No. 4, pp. 180–182*).—The author reports that wheat seedlings grown for one day in dilute potassium nitrate, the next day in $MgHPO_4$, and the third day in $CaSO_4$, these changes being continued in rotation at 24-hour intervals for 4 weeks, grew as large and produced approximately as much dry weight as those grown in complete nutrient solutions of the salts and in other 3-salt solutions that supplied the same ions. The plants grown in these 3 single-salt solutions were also much superior to those grown in other types of single-salt solutions that were changed likewise at 24-hour intervals.

Recapitulating the above conclusions and others as detailed, the author states that the availability and utilization of essential elements by wheat seedlings are not inconsiderably affected by the way in which these elements, presumably as ions, are paired. There is undoubtedly one kind of ion, possibly more, of opposite charge with which any one of the essential ions can be used to best advantage by the plants. There is more than presumptive evidence in the results of this experiment that the proper pairing of nutrient elements, or of ions of opposite charge, is an important factor, and one that does account in a large measure for the physiological adaptability of a nutrient solution for plant growth. Other suggestions are made and discussed.

The growth of field corn as affected by iron and aluminum salts, C. H. Arndt (*Amer. Jour. Bot., 9 (1922), No. 2, pp. 47–71, pl. 1, figs. 6*).—Yellow Dent field corn was grown in two nutrient solutions of greatly different composition in order to determine the effect of such composition, first, upon the amount and form of iron necessary for optimum growth and, second, upon the toxicity of sulphuric, nitric, and hydrochloric acids and their corresponding salts with iron and aluminum.

The results, as detailed, show that the composition of the nutrient solution had a greater influence in determining the toxicity of the salts than the medium

in which the plants were grown. Iron salts when present in injurious concentrations produced a reddish-brown discoloration of the lower portion of the nodal area. Aluminum salts collected in the same position but produced no discoloration.

The occurrence and distribution of manganese in plants (*Kentucky Sta. Rpt. 1922, pt. 1, pp. 35, 36*).—In continuation of a previous investigation of the effect of manganese on plants (E. S. R., 48, p. 126), a brief account is given of sand cultures with nearly 20 species of plants grown in 2-gal. jars of manganese-free sand, with or without the addition of manganese. All plants from which manganese was withheld showed indications of the need of this element, and practically all died without fruiting. The corresponding ones receiving manganese reached maturity. The conclusion is drawn that manganese is necessary for the growth of plants.

Manganese and iron determinations were made in about 60 different kinds of seeds. The results show that in the cereals tested the manganese content was equal to or greater than the iron content, while in the legumes tested the manganese content was less than the iron content.

Cobalt and nickel in plants, G. Bertrand and M. Mokragnatz (*Compt. Rend. Acad. Sci. [Paris], 175 (1922), No. 11, pp. 458–460*).—Nickel was found, though in minute proportions, in carrot, onion, potato, spinach, lettuce, cress, tomato, apricot, bean, lentil, buckwheat, wheat, oat, maize, and rice; cobalt in all of these but oat and carrot.

The H-ion concentration of plant cells, W. R. G. Atkins (*Roy. Dublin Soc. Sci. Proc., n. ser., 16 (1922), No. 30–34, pp. 414–426*).—It is stated that plant cells are rarely alkaline and that pH 8 is not surpassed in them. On the acid side pH 1.4 has been observed.

By a microchemical method it is possible to determine the pH values of the cells and tissues. It has been found that the xylem is more acid than the pith and medullary rays, and the midrib of a leaf more acid than the parenchyma. When grown in neutral or alkaline soil, the root is usually less acid than the other portions of the plant. The influence of soil reaction is reserved for another paper.

The transpiration stream in *Colocasia antiquorum* is almost neutral, as is also the liquid in the leaf-base troughs of *Dipsacus laciniatus*. The pitchers of *Sarracenia* spp. may be as acid as pH 5, and the glandular secretion of *Drosera rotundifoli* may be even more acid.

It has been pointed out that the pH value met with in a tissue is usually near but slightly less than the optimum for the activity of the characteristic enzym at ordinary air temperature. This insures that the acidity does not destroy the enzym at such higher temperatures as may be experienced by the plant under natural conditions.

Attention is drawn to the usefulness of diethyl red as a reagent for microchemical work, as it gives a red in a region where methyl red and brom cresol purple are yellowish. In this range many plant tissues are found to lie.

On the preparation and use of collodium osmometers, W. Brown (*Ann. Bot. [London], 36 (1922), No. 143, pp. 433–439*).—In these practical notes the author shows how osmometers, devised and successfully employed for laboratory work in plant physiology during some years, are prepared and used.

The nature and reaction of water from hydathodes, J. K. Wilson (*New York Cornell Sta. Mem. 65 (1923), pp. 3–11*).—In connection with the study of the growth of bacteria in soils, it was considered desirable to make a study of the presence of certain materials in the exudate water from maize, oats, and timothy plants. The investigation showed that in the exudate water both

inorganic and organic materials were found, and the exuded water proved to be a good medium for the growth of certain soil organisms.

The total solids in the water exuded through the hydathodes from maize plants grown under nonsterile conditions were as high as 1,030 parts per million. In the case of timothy plants grown in closed containers in the absence of microorganisms the exudate contained 573 parts of solid matter per million in one case and 220 in another. In all cases the total solids were more than half organic matter. Reactions were obtained which indicated in the exuded water from maize, oats, and timothy the presence of nitrites, nitrates, materials capable of reducing methylene blue, catalases, and peroxidases. Reductases were thought to be probably present in the water from timothy, but no reaction was observed to indicate their presence in the water from maize.

Development of root system of wheat in different kinds of soils and with different methods of watering, K. SINGH (*Ann. Bot.* [*London*], *36 (1922), No. 143, pp. 353–360, figs. 3*).—The studies here presented, carried out for their bearing upon irrigation problems in the Punjab (India), were confined to growing wheat in pots, the two sets being sown on April 21 and May 31, respectively.

It is stated that wheat plants in pots show better growth when watered from below than when watered from above. The difference is greater in light soil in the early stages of growth, but it is more marked in heavy soil in the later stage of growth.

Under the experimental conditions the development of root and shoot was best in pure sand adequately supplied with water and underlaid with farmyard manure.

The growth of wheat was better in a mixture containing 25 per cent sand and 75 per cent Rothamsted soil than in pure Rothamsted soil or in a 50–50 mixture. Wheat plants did not grow well in brick powder even when underlaid with farmyard manure, though these observations are somewhat preliminary in character.

Further observations on the transpiration, stomata, leaf water content, and wilting of plants, R. C. KNIGHT (*Ann. Bot.* [*London*], *36 (1922), No. 143, pp. 361–383, figs. 3*).—Reporting work related to that previously noted (E. S. R., 35, p. 431; 28, p. 223; 39, p. 223) and employing herein the term "wilting" to denote simply decrease in water content, the author states that simultaneous observations show an increase of transpiration rate to accompany the stomatal opening which occurs during the early stages of wilting.

No correlation was established between the wilting temperature and the increase in transpiration rate or the increase of stomatal aperture. The time elapsing between the commencement of wilting and the attainment of the maxima of transpiration rate and stomatal aperture is dependent on the rate of wilting, the attainment of these maxima representing definite stages of the wilting process. These stages are reached very early, before the water content of the wilting leaf has decreased more than about 1 per cent. The commencement of wilting may be inferred from the flaccid condition of the leaves before it is possible to determine experimentally a definite decrease in leaf water content. The loss of leaf turgidity following such a small decrease in leaf water content indicates that the wall of the normally turgid cell is only slightly distended. The water contents of leaves apparently similar may differ by as much as 2 per cent in *Eupatorium adenophorum*, and more in other species. The diurnal change in leaf water content in southeastern England amounts to less than 2 per cent, much less than the maximum variation (8 per cent) previously recorded for desert habitats.

Methods of healing in some algal cells, S. P. NICHOLS (*Amer. Jour. Bot., 9 (1922), No. 1, pp. 18–27, pl. 1*).—The present article deals with some of the reactions of mature plant cells when punctured. Both fresh and salt water algae were used, the study being confined to Nitella, Chara, and a few of the coarser filamentous algae.

All but one of the algae studied are able to heal a wound. The density of the protoplasm varies with species from a very liquid to a quite viscous condition. No correlation was discovered between the density of the protoplasm and the character of the cell wall. The exuded protoplasm may or may not be miscible with water. If the exuded protoplasm is nonmiscible, the film formed over the escaping protoplasm is not comparable with the plasma membrane. The puncture is not closed by a film or membrane but by an accumulation in the opening of plastids, pyrenoids, and starch granules.

Effect of temperature on germination of Amaranthus retroflexus, C. R. EVANS (*Bot. Gaz., 73 (1922), No. 3, pp. 213–225, figs. 4*).—As regards *A. retroflexus*, which was dealt with in this work, it is stated that the coefficients relating seed germination rate to temperature range from 10.01 at low temperatures down to 0.001 at high temperatures, thus paralleling the coefficients relating growth of seedlings and sore-shin fungus to temperatures as ascertained by workers named. The general trend of these coefficients is the same for seeds only partially afterripened and for those with coat effects almost completely removed by treatment with H_2SO_4 or abrasion with sand. In afterripened seeds with coats untreated the restricting effect of the coats shows particularly at low temperatures (8–10 and 11.6° C.), and again at high temperatures (42° for Washington seeds and 46.1° for Indiana seeds). In both cases these effects can be lessened by treating the coats with H_2SO_4 or abrading them with sand.

Nitrogen fixation in Ericaceae, M. C. RAYNER (*Bot. Gaz., 73 (1922), No. 3, pp. 226–235, figs. 4*).—This is largely a review of the author's paper previously noted (E. S. R., 33, p. 221) and of certain findings related in principle as reported later by Duggar and Davis (E. S. R., 37, p. 129). The summation of experimental evidence notes also the contribution by Ternetz (E. S. R., 19, p. 425).

More recent work of the author, repeating the earlier work with every possible precaution, confirmed as to results that previously noted, with slight exceptions due to conditions which are indicated.

Carbon dioxid manuring, H. FISCHER (*Angew. Bot., 3 (1921), pp. 129–144*).—A critical review of very recent contributions regarding the question of the capability of carbon dioxid in the soil to increase plant growth and production corroborates the claim and points out the need for fuller knowledge regarding the method of its employment.

The toxic action of traces of coal gas upon plants, J. H. PRIESTLEY (*Ann. Appl. Biol., 9 (1922), No. 2, pp. 146–155*).—As a result of experiments in another field of investigation, the author's attention was drawn to some of the cases of injury produced experimentally upon plants by the use of coal gas, and the structural changes resulting from gas poisoning were, therefore, examined. The preliminary results of this examination appeared so significant that they are presented in this paper, which deals with the nature of the injuries produced by traces of coal gas, the toxic constituents of the gas, and the mechanism of the toxic action.

There is said to be clear evidence in the literature that the toxic action of traces of illuminating gas upon plants may be ascribed to the presence of gaseous unsaturated hydrocarbons. A concentration of 1 part of ethylene

in 10,000,000 of air is toxic to the etiolated epicotyl of pea. The effect of these unsaturated hydrocarbons can be traced in the case of the root or etiolated stem to their inhibition of the formation of a functional primary endodermis (which is usually present in these plant structures) by preventing the normal accumulations of unsaturated acids in the region of the future Casparian strip. It is suggested that the effect of traces of these gaseous unsaturated hydrocarbons upon cork formation may be due to the arrest of the normal deposit of fatty acids in the membranes of the cork cells.

The practical significance of this work lies in the fact that definite diagnostic features may now be sought for when injuries to plants are suspected to be due to gas poisoning.

Symbiosis in a deciduous forest, I, W. B. McDougall (*Bot. Gaz., 73 (1922), No. 3, pp. 200–212, figs. 3*).—Employing the concepts "disjunctive symbiosis" and "conjunctive symbiosis," each divided into the phases social and nutritive (the latter meaning either antagonistic or reciprocal), the author gives a preliminary and partial account of a study of symbiosis in all its phases in an area known as the university woods, a 60-acre tract (a remnant of a much more extensive forest) in Champaign County, Ill. The present paper deals primarily with social disjunctive symbiosis, presenting observed relations in descriptive and tabular form.

The interrelations here dwelt upon are claimed to present nothing new except the viewpoint, but they prepare the way for further discussion of other and less known types of symbiosis to be discussed in later papers.

Control of the sexual state in Arisaema triphyllum and A. dracontium, J. H. Schaffner (*Amer. Jour. Bot., 9 (1922), No. 2, pp. 72–78*).—The study here outlined is said to show that sex in Arisaema is dependent on a functional state and not an hereditary factor, that the sexual state is readily controllable and reversible in either direction or both, and that the dimorphism which appears in the inflorescences of these diploid organisms can not be due to homozygous and heterozygous factors or chromosome constitutions.

A demonstration of numerous distinct strains within the nominal species Pestalozzia guepini, C. D. La Rue and H. H. Bartlett (*Amer. Jour. Bot., 9 (1922), No. 2, pp. 79–92*).—Comparisons indicated involved 35 strains (22 from rubber, 7 from coconut, 3 from tea, 2 from oil palm, and one from betel-nut palm) of *P. guepini.* These were measured through 4 to 8 generations. The time period was not the same for all, some requiring twice as long for spore production as others. The statistical studies here recorded show that numerous strains, morphologically distinct from one another, may be isolated, and that these strains do not appear to be confined to particular hosts. It appears that with a sufficiently refined technique a nominal species like *P. guepini* might be resolved into an indefinite number of demonstrably distinct strains, the number depending upon the precision of the methods.

The authors have shown a possible allocation of the 35 strains here used to 14 groups, each containing one or more strains incapable of being placed in any other group. The species concept in the Fungi Imperfecti is of necessity a highly artificial one. The ultimate unit, an impracticable one for purposes of classification, is the pure line descended from a single spore.

Inventory of seeds and plants imported by the Office of Foreign Seed and Plant Introduction during the period from January 1 to March 31, 1921 (*U. S. Dept. Agr., Bur. Plant Indus. Inventory No. 66 (1923), pp. III+91, pls. 8*).—Descriptive notes are given on 549 lots of seed and plants introduced during the period covered by this inventory.

FIELD CROPS.

[**Report of field crops work in Georgia, 1922**] (*Georgia Sta. Rpt. 1922, pp. 5, 6–8, 19, 20, fig. 1*).—The progress of experiments with field crops (E. S. R., 47, p. 427) during 1922 is reviewed.

Red May, strains of Fulcaster, and Dietz wheat, Fulghum and strains of Red Rustproof oats, Abruzzi rye, and Nakano Wase barley were notable among the small grain varieties. Top-dressing oats March 15 gave better results than earlier or later applications, with 100 lbs. of sodium nitrate per acre giving the maximum yield increase of several rates tested. This amount of sodium nitrate was also superior to equivalent weights of other nitrogenous salts for the purpose. Ammonium sulphate and calcium nitrate produced the best results with wheat.

Experiments with cotton on a clay loam soil showed little difference between different kinds of rock phosphate, no decrease due to the mixing of lime with acid phosphate as compared with the phosphate alone, and no advantage in applying over 200 lbs. per acre of 3–8–3 fertilizer where the boll weevil was not controlled. Sodium nitrate made its best returns when applied at the rate of 166 lbs. per acre. In a "triangular" experiment with cotton and corn, nitrogen seemed to be the limiting factor rather than potassium or phosphorus. Late thinning gave reduced yields of cotton, and close spacing increased the early pickings but decreased the late ones. Early dusting with calcium arsenate was more effective than dusting after boll weevil infestation had reached 10 to 15 per cent.

Corn did best when planted in April or early May. Spacing 21 in. apart in 3.5-ft. rows produced better than wider spacing, and plantings in the water furrow were better than on the ridge or level.

Observations are recorded on the palatability to dairy cattle of silage made from green cotton stalks, sweet potato vines, Napier grass, and Japanese sugar cane. Corn for silage produced more dry matter per acre than sunflowers or sorghum, while sorghum made the largest green weight. The thicker stands were the more satisfactory.

Gypsum was without effect on alfalfa, but 50 lbs. of sulphuric acid per acre seemed to increase yields.

An 3–8–3 mixture again made the highest yield in a fertilizer test with sweet potatoes. Plants on beds produced at the rate of 395 bu. of sweet potatoes per acre and those set in furrows 203 bu.

[**Field crops work in Kentucky, 1922**] (*Kentucky Sta. Rpt. 1922, pt. 1, pp. 20–22, 24–26, 27, 28, 30, 36, 37*).—The continuation of earlier work (E. S. R., 48, p. 129) showed that Burley tobacco in a 4-year rotation of wheat, clover and orchard grass, orchard grass, and tobacco has given considerably bettter quality of leaf and average yields than where tobacco follows corn and other crops. In the 3-year rotations, tobacco after a redtop sod was decidedly superior to that grown after wheat or rape. Fertilizer trials with Burley gave results indicating that tobacco may respond to commercial nitrogen where neither manure is added nor crop residue returned, but not where such conditions obtain. Material differences were found in both nicotin content and nitrogen content of Burley wrappers, fillers, and smokers, and also of dark leaf, lugs, and trash. The nicotin content of good hands of White Burley and dark tobacco usually is larger than that of the common hands. The differences in nicotin content, especially in waste and very inferior tobacco, are such that the average percentage is not deemed a safe basis for the proportions of tobacco and water used in an infusion for spraying. Progress is reported in the formulation of grades of Burley and western Kentucky types.

Varietal leaders included Pride of Saline corn, Burt and Fulghum oats, and Fulcaster wheat. Nitrate on wheat resulted in no increase in yield when applied in the fall and a decrease when applied in the spring. The spring application stimulated rank growth which invited disease attacks. The profitable use of nitrogenous fertilizers with hemp is indicated.

In spite of the greater frost resistance of Grimm and Cossack, yields during two years did not show any marked superiority of the hardy strains of alfalfa as compared with the common in Kentucky. Little or no injury resulted from clipping sweet clover the first year, but new growth was not obtained after clipping during the second year at any time or height where the stand was thick and vigorous. The production of a seed crop after the growth has been cut for hay must evidently depend upon leaving some of the lower branches uncut.

Sixty per cent of 50 certified strains of Early Ohio potatoes from Minnesota equaled or outyielded a certified Irish Cobbler check from the same source, suggesting that the low yields often obtained with Early Ohio were probably due to the use of inferior, diseased seed stock. The yields of the strains of both varieties seemed to be in inverse proportion to the amount of degeneration diseases present.

[Field crops work in New Mexico] (*New Mexico Sta. Rpt. 1922, pp. 34–36, 40–44, 45, fig. 1*).—The maximum production in the first year of an irrigation test with potatoes was obtained from the use of 28 acre-in. of water, 8 at the first irrigation and 5 acre-in. in each of 4 applications 14 days apart. The percentage of marketable tubers was good, the water requirement low, and the yield per acre-inch high.

Foremost among the varieties were Sonora spring wheat, Ferguson spring oats, Tennessee Winter and California Feed barley, Acala and Durango cotton, and hairy Peruvian alfalfa. O. A. C. barley led for winter pasture purposes. Hubam sweet clover could not compare with the biennial type.

Winter cereals, particularly the leafy barleys and Turkey wheat, when followed by plowing immediately after harvest and by corn the next year, were found to materially decrease the stand of Johnson grass at a minimum cost under irrigation. Close pasturing during the summer, with early winter plowing, also appeared to be very effective, but was rather expensive on high priced land. Weed eradicating chemicals were tried, but with negative results.

Klein Wanzlebener sugar beets from imported seed yielded about 15.69 tons per acre with a sugar content of 16.4 per cent and purity of 87.7 per cent. Medium size beets had a higher sugar content than the large and small roots. Apparently the best type of soil for beets in the region is a well drained, fertile, friable sandy loam free from perennial weeds. The deeper rooted and more perfect beets were found where water was withheld, except in the earlier periods of growth, until the beets stood upright in the morning, but showed signs of wilting early in the day.

[Report of field crops work in Oregon, 1921–1922] (*Oregon Sta. Bien. Rpt. 1921–22, pp. 42–49, 80, 81, 82, 83, 86, 92–95, 103*).—Variety and cultural trials and breeding work with vetches and related species, red clover, winter and spring wheat, oats, and potatoes, fertilizer tests with red clover and potatoes; seed production; and miscellaneous tests with various legumes, grasses, mixtures, silage crops, and root crops at the station and substations are reported on in continuation with earlier work (E. S. R., 44, p. 826).

For seed purple vetch, Tangier peas, Hungarian vetch, hairy vetch, and woolly podded vetch should usually be grown alone and planted medium early in the fall. From 60 to 80 lbs. of seed of common, purple, and Hungarian vetch suffices under most conditions for seed, and a similar amount, with 40 lbs. of

oats, does for other purposes. When grown in rotation with vetch, the yields of wheat, corn, and oats have increased, whereas potato yields appeared to decline. The vetches appeared to be largely self-fertile.

Red clover seeded in February gave most favorable results with seeding alone and with fall-sown barley and wheat. Although clover seeded alone presents the best appearance, the subsequent yield usually does not exceed that sown with barley or wheat. Spring application of land plaster on red clover resulted favorably, whereas better stands did not follow the use of either lime or sulphur.

Bales of hay properly protected with burlap gained in weight as the winter progressed through March, and then decreased as warm, dry weather set in and returned to near the original weight. The total gain may often amount to from 100 to 150 lbs. per ton.

Highest returns in cultural tests with potatoes were obtained from flat culture, 30-in. rows with plants 12 in. apart, 1.5 to 2.5 oz. seed pieces, early planting, 5.5 in. depth, and treatment of cut seed with land plaster. When 20 bu. of seed per acre was cut into 1-, 2-, and 3-oz. pieces, respectively, the larger yields resulted from the smaller pieces planted closely. Plats of 1.5 oz. whole blossom-end seed gave 27 bu. more per acre than split blossom-end pieces of similar size. The use of whole blossom-end pieces also gave rise to more marketable tubers than the split blossom-end. Storage experiments in pits showed the need for thorough ventilation, and that considerable shrinkage and loss occurs even under well-ventilated conditions.

Peas and oats gave the best results as a silage and soiling crop at the Astoria Substation with a reduction in yield of about 0.5 tons per acre occurring for each week delay in planting after March 1. Most round varieties of potatoes tend to be of poor quality in the section and are subject to internal browning.

Varieties of field crops for dry land and irrigation and rates and dates of seeding are indicated from results at the Harney Substation. Tillage studies suggest that in central Oregon the summer fallow should be plowed early in the spring and then kept free from weeds. A 2-year rotation of grain after field peas and a 6-year rotation of 4 years of alfalfa and 2 of grain have given the best results. Federation spring wheat made 61.1 bu. per acre in the short rotation as compared with 23.3 bu. on plats cropped continuously to grain since 1917. Grain after alfalfa in the 6-year rotation yielded 26.6 bu. more than on continuous cropping. Results to date in duty-of-water experiments indicate the best returns from 12 acre-in. per season for cereals, 18 for alfalfa, 12 to 15 for field peas, 15 for clover, 20 for Mammoth Russian sunflowers, 18 for peas and oats, 10 for potatoes, and 12 acre-in. for beets and mangels.

Grimm with 6.66 tons per acre was the highest yielding alfalfa variety at Umatilla Substation (E. S. R., 44, p. 136), where about 80 per cent of the regional crop income is derived from alfalfa. A pasture mixture recommended for the project is orchard grass 6 lbs., Kentucky blue grass 6, meadow fescue 4, smooth brome 4, and alsike clover 2 lbs.

The results of varietal comparisons, breeding work, seeding tests, and tillage experiments with winter and spring wheat at the Moro Substation have been noted earlier (E. S. R., 47, p. 533).

[Report of field crops work in Rhode Island, 1922] (*Rhode Island Sta. Bul. 193 (1923), pp. 8, 9, 10, 12, 13*).—Supplementing previous work (E. S. R., 47, p. 736), the progress is reported of comparisons of varieties of soy beans for silage and of pole beans in drills with corn, tests of rye varieties and varieties and hybrids of potatoes, and rotations.

[Report of field crops work in India, 1921–22] (*India [Dept. Agr.] Rev. Agr. Oper., 1921–22, pp. 2–30, 32–39, 44–49, 56, pls. 3*).—Experiments with field crops (E. S. R., 47, p. 824) conducted by the Imperial and Provincial Depart-

ments of Agriculture in different centers in India in the year 1921–22 are reviewed.

An investigation of methods of testing the maturity of sugar cane at Coimbatore gave indications that the cane ripens by joint, and that the most suitable time for cutting is when both the top and bottom joints show refractive indices with a ratio close to unity. The coefficient of purity was not found to be a reliable criterion upon which to judge the maturity of cane. Similar work at Jorhat showed that when the coefficients of purity of juice of the bottom and top thirds of the stalk approach to within 2 or 3° of each other, the cane is ready for milling. Meggitt ascertained that the quality of juice continues to improve for about four months after free early flowering, and that the juice expression does not decline appreciably.

Agricultural Experiment Station of the Central Institute (Sweden), 1922.—Brief guide for visitors, H. VON FEILITZEN (*Centralanstaltens för Jordbruksförsök Fasta Försöksstation vid Experimentalfältet år 1922. Kort Vägledning för Besökande. Stockholm: O. L. Svanbäck, 1922, pp. 31, figs. 3*).—A handbook briefly describing the location, climate, area and fields, type of soils and their chemical composition, lysimeter installation, lines of work, etc., of the station, and giving a brief review of the station's history.

Dry farming investigations at the Scottsbluff Substation, L. L. ZOOK (*Nebraska Sta. Bul. 192 (1923), pp. 23, fig. 1*).—Results from dry-land crop rotation and cultural experiments, conducted at the Scottsbluff Substation in cooperation with the U. S. Department of Agriculture, from 1911 to 1921, inclusive, are reported, and farming practices based thereon are recommended. Reviews of the work from 1911 to 1919, inclusive (E. S. R., 45, p. 530), and with winter wheat (E. S. R., 46, p. 837) have already been noted at some length.

Crop production studies indicate that corn should be the predominating crop in a system of dry farming in the region. Since the yields of the small grains did not differ greatly, their choice depends on their value or intended use. Sorghum in cultivated rows is the best forage crop.

Differences between yields on spring and fall plowing were not significant, and disking corn land for spring grain gave as good yields as, and should be preferred to, either time of plowing. Yields of spring wheat and oats were consistently higher on corn land than after a grain crop. The average acre yields of all crops have been higher on fallow than under continuous cropping, those of small grain on fallow being often more than double those of grain after grain. However, small grains were generally more profitable on corn land than on fallow, the value of the corn produced more than offsetting the value of the additional grain made on the fallow land. Since green manuring was followed by reduced yields and increased cost as compared with fallow, its use is not justified in general dry farm practice in the section.

Sixteen years' grain production at the North Platte Substation, L. L. ZOOK and W. W. BURR (*Nebraska Sta. Bul. 193 (1923), pp. 52, figs. 6*).—The more important results obtained in studies of crop production at the North Platte Substation from 1907 to 1922, inclusive, are reviewed. The experiments, which embraced rotations and varietal, cultural, and seeding tests with corn, winter and spring wheat, oats, and barley, have already been reported upon extensively from other sources (E. S. R., 46, p. 837; 47, p. 735). Important varieties of winter wheat tested are described and their behavior indicated. Records of the precipitation and evaporation during the period of the investigations are also tabulated and discussed.

[Cereal studies in South Dakota], A. N. HUME (*South Dakota Sta. Rpt. 1922, pp. 12, 14*).—Results with Marquis wheat were similar to those previously obtained with Bluestem (E. S. R., 43, p. 235), showing that a slight correla-

tion exists between higher yield and greater length of spikes used as mother heads for the first generation, but that this disappears in the succeeding generation.

J. G. Hutton reports that during 7 years at Brookings, a live-stock system of cropping where manure is returned yielded 40.8 bu. of corn and 63.8 bu. of oats per acre, while the grain system where crop residues are returned and no manure is applied yielded 43.7 bu. of corn and 71.6 bu. of oats.

Comparative morphology and development of Poa pratensis, Phleum pratense, and Setaria italica, M. NISHIMURA (*Japan. Jour. Bot., 1 (1922), No. 2, pp. 55–85, pls. 4, figs. 2*).—Studies of the life histories of Kentucky blue grass, timothy, and foxtail millet are presented, with special emphasis on the characteristic features associated with germination and stages in the development of the plant and the inflorescence. Polyembryony in *Poa pratensis* is discussed briefly.

The textile industry: Flax, hemp, jute, and their substitutes, A. RENOUARD (*Dictionnaire Méthodique Illustré par Catégories d'Opérations. Les Industries du Lin, du Chanvre, du Jute et de leurs Succédanés. Paris: Ch. Béranger, 1921, pp. XXVII+565, figs. 106*).—This volume lists and gives French, English, German, and Italian equivalents for the terms met with in agricultural, preparatory, spinning, and weaving operations, and the handling of the finished products of flax, hemp, jute, and substitutes. Tabulated information used in the textile industry is appended, together with a bibliography, lists of textile schools and dealers in textile machinery and supplies, and alphabetical indexes in the languages involved.

Genetic studies in barley, K. MIYAKE and Y. IMAI (*Bot. Mag. [Tokyo], 36 (1922), No. 422, pp. (25)–(38), fig. 1; abs. in Japan. Jour. Bot., 1 (1922), No. 2, p. (24)*).—Investigation of the genetic behavior of barley revealed to the authors 16 pairs of allelomorphs affecting plant habit, spikes, glumes, awns, grains, etc. The allelomorphs responsible for the production of the awn of the lateral rows of the spike probably consist of three factors. Linkages were frequent, and one large group comprised four or probably five factors and another five factors.

The story of the maize plant, P. WEATHERWAX (*Chicago: Univ. Press, 1923, pp. XV+247, pls. 2, figs. 174*).—The principal aim of this volume is to give accurate information and illustrations concerning the structure of the corn plant and its component parts or organs and their functions. Supplementing the botanical facts are chapters dealing with nomenclature and relationships, history and distribution, botanical origin, ecological relations, agricultural practices, heredity, breeding, products and uses, and corn in aboriginal and modern American life. A selected bibliography is appended.

Cotton, the universal fiber, W. D. DARBY (*New York: Dry Goods Econ., 1922, pp. 68, pls. 12*).—An exposition of the cotton industry from the raw material to the finished product, with descriptions of marketing and manufacturing methods and a glossary of cotton fabrics.

The structure of the cotton hair and its botanical aspects.—II, The morphology of the wall, H. J. DENHAM (*Jour. Textile Inst., 14 (1923), No. 4, pp. T 86–T 113, pls. 8, figs. 26*).—Supplementing an earlier contribution (E. S. R., 48, p. 32), recently observed characteristics of the cotton fiber are described and illustrated. Notes are appended on the interpretation of microscopic images of cotton and vegetable fibers.

Striations occur in all parts of the fiber and in all layers of the wall, and convolutions caused by a double spiral line of weakness follow the direction of the primary wall striations. The convolutions may be grouped into normal, movable, preformed, and suppressed classes, which may influence considerably

the spinning qualities of the fiber. Slip planes occur widely in cotton, as do lines of failure due to buckling. The slip planes are indicated as primarily due to internal stresses in the boll, but can be produced under certain conditions in dry material and may occur in a spiral plane. Mosenthal or "beaded" pits are a special form of slip plane involving distortion of longitudinal striations, with or without fissuring of the surface between such striations.

Some abnormalities are due to the tendency of the fiber to fill up all available boll space. Internal boll space and boll pressure exert a great influence on fiber conformation. No true pits exist in the wall, but areas of marked permeability occur in a double spiral pattern.

The cotton-growing countries: Production and trade, J. HUBBACK (*Rome: Internatl. Inst. Agr., Statis. Bur., 1922, pp. XXIV+147*).—An English edition of the work noted earlier (E. S. R., 49, p. 32).

A natural hybrid between Avena fatua and A. sativa, with yellow glumes, C. CREPIN (*Ann. École Natl. Agr. Grignon, 7 (1920–21), pp. 143–154, figs. 5*).—A plant appearing in a plat of Golden Rain oats had characteristics of both *A. fatua* and Golden Rain. Studies of this case suggested to the author a possible cause of degeneration in cultivated oats.

Potato seedlings, V. DUCOMET (*Ann. École Natl. Agr. Grignon, 7 (1920–21), pp. 114–142*).—Observations on seedlings of a number of potato varieties are summarized, with a discussion of rejuvenation and amelioration of potatoes.

No two hills were found alike in some varieties, whereas it is said that stability was absolute in others. The varieties with claviform tubers appeared to be especially stable, while those with round tubers were more variable. It was observed that in the progeny of seedlings the eyes tend to deepen and the eyebrows to enlarge, these characters being related to the degree of stolonization. The sinking of the eyes is itself correlated with an increase in the number of eyes, which is a function of the relative length of the tuber.

Modifications observed either in the first or following generations included either a considerable reduction or extreme lengthening of the sepal tips, modification of the normal form of the corolla to a substar shape resembling that of other Solanums, and a change in the form of the seed balls from spherical to heart shaped.

Examination of at least two generations appeared necessary to determine stability. Stable forms were always obtained in two generations, both where the population of the F_1 was nearly homogeneous as in Lesquin, Jaune d'Or, Royal Kidney, or Reine des Farineuses, and in the seed plats where all of the F_1 and most of the F_2 were manifestly heterogeneous, as in Merveille d'Amérique, Wohltmann, and New Export.

Better seed potatoes for Oklahoma, W. A. RADSPINNER (*Oklahoma Sta. Circ. 54 (1923), pp. 7*).—Practical instructions for the selection and care of seed potatoes in Oklahoma. A comparative test between certified seed from several sources and ordinary stock showed the certified potatoes to produce larger yields with more marketable tubers.

The cultivation of tenggala paddy, D. H. GRIST and S. A. RAHMAN (*Agr. Bul. Fed. Malay States, 9 (1921), Nos. 1, pp. 5–22, pl. 1; 2, pp. 131–153; 4, pp. 241–257*).—The "tenggala" system of rice culture practiced in Pahang district, Federated Malay States, is described, together with suggested catch and cover crops; the results of cultural, rotation, and varietal tests; cost of production studies; and agronomic notes on the varieties employed. According to the "tenggala" or plowed method, the land is cropped about four times to rice and is then fallowed from four to six years, reverting to grass or secondary jungle and becoming pasture for buffaloes.

On the relation of leaf area to productivity in the soy bean, I. NAGAI (*Nôgaku Kwaihô [Jour. Sci. Agr. Soc. (Japan.)], No. 228 (1921), pp. 603–624; abs. in Japan. Jour. Bot., 1 (1922), No. 2, pp. (25), (26)*).—Observations on 114 varieties of soy beans at the Ômagari Agricultural Experiment Station show that intervarietal differences in the yield of soy beans are closely correlated with the respective differences in the leaf area and certain other characters when grown under similar conditions. The intervarietal correlations found between characters were as follows: Yield and the mean area of a single compound leaf +0.64±.057, mean area per plant and mean height +0.74±.042, mean area of a single compound leaf and mean height +0.65±.055, total leaf area per plant and area of single compound leaf +0.87, weight of 100 seeds and mean area of single compound leaf +0.47±.075, and weight of 100 seeds and mean height +0.3±.087.

The varieties grown in northern Japan generally have a larger size of the seed and leaf area than those grown in the southern parts. The tendency of large seeded varieties to make a quicker growth at the beginning of the growing season than do the smaller seeded ones was shown among 49 varieties by the coefficient of +0.64 between the height of plants 49 days old and the weight of 200 seeds.

The magnitude of assimilation by the leaf in the field and its relation to climatological factors was also studied.

Hungarian vetch in Oregon, H. A. SCHOTH (*Oregon Sta. Circ. 46 (1923), pp. 4*).—Brief directions are given for the production of Hungarian vetch in Oregon, including notes as to its adaptation, uses, time, method and rate of seeding, inoculation, fertilizing, and harvesting and seed-cleaning methods.

Further notes on effect of extent of root systems on tillering of wheat, W. F. GERICKE (*Bot. Gaz., 75 (1923), No. 3, pp. 320–322*).—In further tests (E. S. R., 47, p. 636) with wheat plants of the same age, but differing markedly in extent of root growth, the cultures having the largest root systems when placed in the nutrient solution produced significantly more tillers than did those with smaller root systems. Averages of 20 tillers per culture were obtained where the roots were from 50 to 60 cm. long, 16.7 from 30 cm. roots, and 11.2 from 4 cm. roots.

The miller's almanac (*Minneapolis: Northwestern Miller, 1923, pp. 267, figs. 43*).—A compilation of statistical and general information concerning the milling industry and the grain trade.

Prevalence of dodder in Great Britain (*Jour. Min. Agr. [Gt. Brit.], 30 (1923), No. 1, pp. 38–41*).—A survey disclosed that dodder does not exist or is rare in Scotland and in the counties north of the Trent, including Lincoln. The pest seems to be more prevalent in the southern and eastern counties, particularly in East Suffolk and Northampton. Although sporadic cases were noted in Kent and East Sussex, and some dodder is encountered in parts of Hereford and Warwick, it does not appear to be present to any harmful extent in Wales, Stafford, Shropshire, Worcester, Gloucester, or in the southern counties from Hampshire to Cornwall. *Cuscuta trifolii* is the species most common in Great Britain.

Control of the whorled milkweed in Colorado, W. L. MAY (*Colorado Sta. Bul. 285 (1923), pp. 24, figs. 8*).—Experiments with chemical sprays for the control of whorled milkweed are reported, supplementing cultural methods noted earlier (E. S. R., 43, p. 141). Preliminary trials eliminated all chemicals except sodium arsenite.

The results secured suggest making the first application of the sodium arsenite solution, preferably equivalent to 200 lbs. of white arsenic per acre, about the time the earliest plants are beginning to form flower buds. The

second application may be made when shoots not out of the ground at the first spraying have attained the early blooming stage. Effort is made to wet only the aerial parts with the latter application and not to soak the soil.

Much stronger solutions of sodium arsenite seem necessary for results in arid regions than where the relative humidity is high. The use of dilute solutions of the arsenite to control annuals growing in untillable areas is suggested to prevent later infestation of agricultural land. From the results obtained in these tests, it is indicated that the weaker solutions (about 1 lb. of white arsenic to 10 gal. of water) might be very effective against taprooted and woody-rooted types of perennials.

HORTICULTURE.

[Horticultural investigations at the Georgia Station] (*Georgia Sta. Rpt. 1922, pp. 16, 17–19, 20, 21, 22, fig. 1*).—The Pineapple pear, of value on account of resistance to fire blight, is deemed worthy as a preserving and baking variety.

In a qualitative test of fertilizers for garden peppers it was found that nitrogen was the most valuable element, increasing yields and promoting a heavier foliage development in the plant. However, nitrogen-treated plants were more susceptible to attacks of blossom-end rot. It is recommended that from 500 to 800 lbs. of a 4–8–4 fertilizer be applied at the time of planting peppers, later supplemented with a side dressing of 70 lbs. of sulphate of ammonia or 100 lbs. of nitrate of soda. Planted in rows 3 ft. apart, peppers spaced 1 ft. apart in the row were much more productive than those spaced either 2 or 3.5 ft. Good crops of leaves were obtained from digitalis plants set out as seedlings in the fall. However, as a rule the plants were injured by the hot weather prevailing in midsummer.

[Horticultural investigations at the Indiana Station] (*Indiana Sta. Rpt. 1922, pp. 35–37, 38, fig. 1*).—Brief notations are made upon progress attained during the year (E. S. R., 47, p. 138). Straw mulch and cultivation with cover crops continued to show superiority to sod as cultural practices in apple orchards. Nitrate of soda applied in the spring of 1921 to portions of all the plats resulted in increased production and tree growth on the grass plats. As evidenced by trunk girth and total growth measurements, lightly pruned trees continued to make more growth than heavily pruned trees. Spraying proved more effective and more economical than dusting in the control of apple scab.

Selection studies with the tomato for increased yield have shown positive results. Baltimore selections, the parents of which produced from 10 to 15 tons per acre, in 1920 yielded an average of 20.78 tons. Forty-one selections, the parents of which produced from 15 to 20 tons in 1920, yielded an average of 22.19 tons in 1921.

Studies in sweet corn seed production showed that plants from large kernels not only give a slightly more uniform and heavier yield than those from small kernels but also mature at a different time.

[Horticultural investigations at the Kentucky Station] (*Kentucky Sta. Rpt. 1922, pt. 1, pp. 38, 39, 40*).—A comparison of light and heavy pruning on young apple trees in the station orchard indicated very decidedly that severe pruning retards the commencement of fruiting and reduces production. In the spring of 1922 there were recorded 17.5 per cent full bloom, 17.9 moderate bloom, 21.2 scanty bloom, and 43.4 per cent no bloom for lightly pruned trees, as compared with respective percentages of 4.2, 7.4, 23.8, and 64.6 for the heavily pruned trees. The Douglass pear, productive and bearing fruit of good quality,

indicated particular merit on account of freedom from blight, although surrounded with severely diseased trees.

[**Horticultural investigations at the New Mexico Station**] (*New Mexico Sta. Rpt. 1922, pp. 20–26, 37, 38*).—Orchard heating experiments, discussed in a previously noted bulletin (E. S. R., 48, p. 837), are again reviewed in some detail.

Results of cabbage fertility tests on a good loam soil indicated the high value of barnyard manure in promoting the yield of this crop. The computed yield per acre on the plat receiving 30 tons of manure and 120 lbs. of potassium sulphate was 25,596 lbs., as compared with 12,840 lbs. for the highest yielding check. In a test of commercial fertilizers for cabbages grown on a light sandy soil, the complete fertilized plat yielded 7,680 lbs. per acre, as compared with only 520 lbs. for the check area.

A study in cabbage irrigation has shown that this crop may be grown successfully with a comparatively small quantity of water, a yield of nearly 9 tons per acre having been secured with the use of 16 acre-inches of water.

It was found that almond trees grow vigorously on the station grounds but lose their fruit blossoms each year in the early spring frosts. All varieties of English walnuts except the Pomeroy winterkilled. The pecans, with the exception of freeze injury during the winter of 1921, have proved satisfactory, and several of the varieties have borne fair-sized crops. In a comparison of stump v. trellis training for the Vinifera grape, no advantage was found in trellising.

[**Horticultural investigations at the Oregon Station**] (*Oregon Sta. Bien. Rpt. 1921–22, pp. 66–70, 71, 72*).—This report, similar to that of the preceding period (E. S. R., 44, p. 835), covers the horticultural activities for the biennium ended June 30, 1922.

Pruning studies emphasized the need of recognizing the characters of the individual variety. Studies indicated that the set of fruit on a spur is practically proportional to the leaf area remaining after various degrees of defoliation. The food constituents of the spur showed corresponding variations. Fruit bud formation was prevented if the spur had an insufficient leaf area. By combining defoliation and girdling, fruit setting and fruit developing processes of the spur were practically controlled, and the relative value of the nutrients coming from various portions of the tree was determined.

Studies with the filbert revealed the fact that, while pollination occurs in January or February, the act of fertilization does not take place until June. All varieties of filberts under test proved self-incompatible. The Ettersburg No. 121 strawberry, found self-compatible, is recommended as a superior variety. Of a block of 360 sweet cherry seedlings, everyone proved self-incompatible, but certain of the seedlings indicated promise as pollinizers for commercial varieties.

Greenhouse studies indicated that a satisfactory rotation consists of tomatoes March to August, followed by three crops of spinach or by a fall crop of tomatoes and one crop of spinach. When hand pollinated 80 per cent of the blossoms of greenhouse tomatoes set fruit, as compared with 50 per cent for naturally pollinated flowers. Marked variations were recorded in the time of maturity and the quality of 13 seed strains of the St. Valentine broccoli. Blackberries treated with 250 lbs. of nitrate of soda and ammonium sulphate per acre yielded approximately one-sixth more than the untreated plats.

[**Horticultural investigations at the Hood River, Oreg., Substation**] (*Oregon Sta. Bien. Rpt. 1921–22, pp. 89, 90, 91*).—Studies conducted in Hood River Valley orchards indicated that nitrogenous fertilizers are valuable, es-

pecially on soils in which cover crops have not been fully established. Nitrate of soda was found to benefit strawberries, especially on "red shot" soils. Heavy applications of nitrogen supplemented with light applications of potash produced abundant yields of strawberries, but potash used alone apparently caused the production of small seedy berries. Immediately following the close of the fruiting season proved the most satisfactory time for mowing the leaves of old strawberry beds. Time of picking studies with Esopus [Spitzenburg] and Yellow Newtown apples and the Anjou pear showed that October 6 is a favorable date for Esopus, October 15 for Yellow Newtown, and October 1 to 8 for the Anjou pear.

[**Horticultural investigations at the Rhode Island Station**] (*Rhode Island Sta. Bul. 193 (1923), pp. 9, 10, 11, 13*).—Observations on spinach varieties indicated that Savoy and Giant Thick-leaf were of earlier maturity than Long Standing and Victoria. Copenhagen cabbage produced heavier heads than did either Charleston or Jersey Wakefield. Black-seeded Tennis Ball lettuce sown April 14 produced large solid heads.

Records taken in 1922 on asparagus plats liberally and uniformly fertilized in 1921 with nitrogen and phosphorus, but with various amounts of potassium oxid, sodium chlorid, and sodium carbonate indicated that with equal degrees of soil acidity sodium chlorid was more effective in promoting yield than was sodium carbonate. With insufficient potassium both of the sodium salts were useful up to the maximum amounts applied.

Further attempts to grow greenhouse lettuce without manure showed that unless extremely large applications, 15 tons of acid phosphate and 4 tons additional limestone per acre, were used, much better results were secured with the manure. It was found that very large applications of chemicals reduced the active aluminum to about one-third of that in otherwise comparable areas on which lettuce was making an unsatisfactory growth.

On a composted soil comprised of soil, sand, commercial humus, and chemicals, radishes and spinach yielded about the same as on manure compost. The tomato crop succeeding the radish and spinach was also nearly as productive on the chemical as on the manure compost. Five-year averages for late cabbage grown in succession to spinach, beets, potatoes, and peas were 8.88, 8.84, 8.55, and 7.8 tons per acre, respectively.

[**Horticultural investigations at the South Dakota Station**], N. E. Hansen (*South Dakota Sta. Rpt. 1922, pp. 22–24*).—Fruit breeding, the main object of which is the origination of hardy varieties of good quality, continued to be the major activity of the department of horticulture. Four crab apple hybrids, designated as Kola, Tipi, Shoko, and Zapta, were distributed for the first time in the spring of 1922. Four apple varieties, the Goldo, Oxba, Linda Sweet, and Maga crab, obtained by crossing various Russian apples and Siberian crabs with standard apples, were also distributed. The Beauty crab, a selection of *Pyrus baccata*, is recommended as a long keeper. The Ojibwa, Pembina, and Cree plums, hybrids between the native Manitoba and the Japanese species, are considered promising. The Hopa red flowered crab apple shows considerable merit as an ornamental for lawn planting.

[**Pomological investigations at the Talent, Oreg., Substation**] (*Oregon Sta. Bien. Rpt. 1921–22, pp. 97–100*).—This is a further report upon investigational activities (E. S. R., 44, p. 837). Among promising European pears fruiting at the station are listed Dr. Jules Guyot, a variety similar to Bartlett but earlier in maturity, and Besi de Beugny and Baronne de Mello, late russet varieties similar to Winter Nelis.

A test of several kinds of crude oils advertised for orchard heating uses showed great variation in the duration of the burning period and in the amount

of residuum left after burning. The Scheu heater proved superior to others in the length of the burning period and in the ability to thoroughly consume inferior grades of oil.

To test the theory that light frosts are responsible for poor sets of fruit on the Anjou pears, an individual tree was protected and warmed on all frosty nights. However, the set of fruit was no better than on unprotected trees. Anjou trees blooming at the same time as neighboring Bartletts failed to set a satisfactory crop, leading to the conclusion that Bartlett is not a good pollinizer for this variety. Black Tartarian and Black Republican cherries showed value as pollinizers for other sweet cherries and are therefore recommended for interplanting in all newly set orchards at the rate of 1 to every 20 trees. Two vetches, the woolly podded and the Hungarian, promise to be of value as cover crops on the heavy orchard soils of southern Oregon.

Results of dusting v. spraying in Connecticut apple and peach orchards in 1922, M. P. Zappe and E. M. Stoddard (*Connecticut State Sta. Bul. 245 (1923), pp. 229–243*).—In this as in the report of the preceding year (E. S. R., 47, p. 140), data are presented upon the results of field experiments conducted in four apple and two peach orchards in Connecticut for the purpose of determining the value of dusts and sprays for the control of various fungus and insect pests. As in 1921, sprays were more effective than dusts in all the apple orchards.

In the first peach orchard, composed of Elberta and Carman varieties, spray controlled brown rot slightly better than did the dust, while in the second peach orchard, composed of Elberta and Champion varieties, the dust was slightly more effective. Peach scab, present in only one of the two orchards, was equally well controlled by either treatment.

In general apple trees sprayed or dusted five times yielded a higher percentage of uninjured fruits than did those trees receiving only three applications. A comparison of sulphur-nicotin-arsenate dust and the Sanders copper lime dust in one of the apple orchards composed of 46-year-old Baldwin and Greening trees showed little difference between the two forms, the percentage of good fruit from the Baldwin trees being approximately the same for both dusts. Upon the Greening trees the Sanders dust gave better control of fungus diseases, while the sulphur-nicotin-arsenate material was superior in respect to the suppression of aphis and certain chewing insects.

As a result of the tests it is suggested that dusts may be used in apple orchards where fungus pests are not likely to be present. However, in order to secure the highest grade of fruit reliance must be placed on sprays.

Spray calendar, W. E. Britton and G. P. Clinton (*Connecticut State Sta. Bul. 244 (1923), pp. 179–226, figs. 99*).—This is a revision of a previously noted bulletin (E. S. R., 44, p. 836).

Final report on the cooperative experiments in orchard fertilization, R. C. Collison and J. D. Harlan (*New York State Sta. Bul. 503 (1923), pp. 3–30*).—In presenting this final report (E. S. R., 44, p. 534) upon nutritional investigations in apple and cherry orchards in western New York, the authors, utilizing the "Student" method of determining the significance of variations between treatments, conclude that with one exception, namely, that of nitrogen fertilizer in a Montmorency cherry orchard at Geneva, fertilizers have failed to exert any appreciable effect on either growth as measured by trunk diameters or upon yield of fruit.

In a Baldwin apple orchard at Albion, the trees of which were 38 years old at the beginning of the experiment in 1912, no kind of fertilizer had any apparent effect upon growth of trees. Nitrogen when used alone apparently increased yield, but when used in combination with phosphorus and potash

gave no significant increases, leading the authors to believe that other factors besides fertilization must be involved. Inconsistencies in growth responses found in a Baldwin orchard near Rochester are likewise deemed to be due to other factors than nutrient supply.

Measurements taken in a young Northern Spy orchard at Fulton indicated that nitrogen and phosphorus had influenced growth as displayed by increase in trunk diameter. In respect to yield of fruit in the above mentioned cherry orchard at Geneva, only one treatment, namely, the complete fertilizer, showed any positive effect.

Commenting upon the results of the studies, the authors conclude that from a practical viewpoint it has not paid to use commercial fertilizers in these well cared for orchards, and recommend, therefore, that fruit growers pay more attention to general management items, such as cultivation, spraying, and pruning, and less to fertilization.

The data for the several orchards are appended in tabular form.

Commercial fertilizers in New York orchards, J. D. Luckett (*New York State Sta. Bul. 503, pop. ed. (1923), pp. 2*).—This is a popular edition of the above.

Fertilizing apple orchards, U. P. Hedrick (*New York State Sta. Circ. 66 (1923), pp. 8, fig. 1*).—The information presented in this circular is based upon previously noted investigations (E. S. R., 42, p. 344), the original reports upon which are now unavailable for distribution. Emphasizing the fact that many of the well managed orchards located on the fertile soils of western New York do not need commercial fertilizers, the author outlines a simple field test whereby the grower may determine for himself the requirements of his own soil. It is suggested that such tests be conducted before large sums of money are expended for general fertilization.

Grape growing in Oregon, C. E. Schuster (*Oregon Sta. Circ. 43 (1923), pp. 16, figs. 5*).—The various phases of grape growing, including selection of varieties, planting, training, cultivation, pruning, etc., are discussed. Campbell Early has been found to be the best of the American varieties for Oregon conditions, and where sufficiently hardy the Flame Tokay is the most satisfactory European sort.

FORESTRY.

Physiological requirements of Rocky Mountain trees, C. G. Bates (*Jour. Agr. Research [U. S.], 24 (1923), No. 2, pp. 97–164, pls. 7, figs. 5*).—Extensive studies by the Forest Service, U. S. D. A., upon the effect of certain environmental factors, such as moisture and temperature of air and soil, sunlight, etc., upon the development of young trees of several Rocky Mountain forest species indicated marked differences in the requirements of the various species.

Observation upon the water requirements of trees of six species introduced into a greenhouse in the spring of 1917 showed that in making a unit of gain in dry weight, the limber pine, the greatest water user, absorbed almost four times as much water as did the Engelmann spruce, the minimum user. The limber pine, described by the author as a weed tree, apparently used a large amount of water without making much growth.

Repetitions of the test in 1920 with more species and with more trees of each species showed some radical departures from the 1917 results, leading the author to suggest that the condition of the individual tree is probably a very important factor. The amount of transpiration per unit of mass or leaf exposure was apparently directly affected by the amount of new growth made.

Determinations of the sap density of the various species included in the 1917 studies showed a definite correlation between density of sap and water requirements, the high water users having the low sap densities. Apparently photosynthetic activity, by increasing the amount of soluble carbohydrates, increased the density of the sap; therefore, photosynthesis, sap density, and water requirements are believed to be interrelated.

Determination of the sap density of the 1920 experimental trees showed a general range much lower than that of 1917, indicating that the sap density of a given species is by no means constant, but may be quite strongly influenced by environmental conditions. It is suggested that sap density is subject to a definite cycle of changes in accordance with the seasons of the year. Density studies with material gathered in the period of vernation and during midwinter showed further inconsistencies. It is believed that the high sap density of Engelmann spruce enables this species to endure great losses of moisture without injury.

In wilting coefficient tests conducted in 1920 with seedlings grown in pans of typical forest soils, the yellow pine, Douglas fir, and Engelmann spruce had essentially the same coefficient in all the soils. Douglas fir on account of its sturdy fibrous root system did not readily manifest wilting injury. Of the several soils under observation, the coarse grained granitic soils of the Pikes Peak region were, down to the wilting point, low in moisture retaining capacities. It is concluded that there is no essential difference in the drought resisting ability of yellow pine, Engelmann spruce, and Douglas fir. Lodgepole pine was found to succumb to drought much sooner than any of the above species.

In order to determine differences in heat resisting capacities of the several species, seedlings were exposed to high temperature in direct sunlight. Engelmann spruce and lodgepole pine were found susceptible to injury and Douglas fir and yellow pine resistant. Because of the fact that temperatures occurring during the test were not extreme, 135° F. at the surface of the soil, it is believed that the injuries received were due to transpiration losses rather than direct temperature effect on protoplasm.

Observations on the comparative resistance of young nursery trees to winter injury led to the conclusion that the Engelmann spruce can endure drying winds better than either the Douglas fir or the yellow pine. Lodgepole pine suffered injury to exposed branches and leaders, probably on account of incomplete maturity. The Engelmann spruce is considered by the author to be the most highly developed of the indigenous species of the region in its ability to make use of all conditions of environment.

On the ecology of British beech woods with special reference to their regeneration, A. S. Watt (*Jour. Ecology, 11 (1923), No. 1, pp. 1–48, figs. 2*).—Extended investigations of the causes of failure of natural regeneration in British beech woods indicated that a number of adverse factors contribute to the situation. By protecting seeded areas with cages designed to exclude various animals and birds, it was found that certain small animals (mice, squirrels, rabbits, etc.) were exceedingly destructive, especially when the nuts were lying fully exposed on litter-free surfaces. The character of the soil apparently had an important relation to germination of the nuts, in that in hard-packed soil nuts planted 1 in. deep failed to grow whereas in humus excellent germination was obtained with 3-in. planting. Nuts immersed in water for 0, 2, 5, 10, 15, and 20 days gave respective germinations of 70, 60, 50, 60, 20, and 30 per cent, indicating that immersion for an extended period is deleterious. Nuts suspended over and nuts completely submerged in water failed to germinate, while those half submerged were 80 per cent viable. From

these and other studies of water relations, the author concludes that it is necessary to have a film of water in contact with the nut during the entire period of germination.

Of the various enemies which beset the young seedling after germination, none is more persistent than the rabbit, which may destroy trees several years of age. Many germinating nuts are killed by the inability of the radicle to penetrate the hard soil, by drought injury, or by injury from mice or rabbits. Mollusks, caterpillars, and beetles often attack the sprouting seedling, and in seasons of early germination frosts are often a limiting factor.

The beech canopy is often sufficiently dense to handicap regeneration, and wherever openings occur *Rubus fruticosus* and other undergrowth usually spring up, to the detriment of young beeches. It was observed that the beech produces a full crop of nuts at rare intervals, and for the most part regeneration occurs in these years, when the number of nuts produced is sufficient to allow a small percentage to escape the many enemies.

Trespass on national forests of Forest Service District 1, P. J. O'Brien (*U. S. Dept. Agr., Forest Serv., 1922, pp. 125*).—A digest of fire, game, property, timber, occupancy, grazing, stock and herd, sanitation, and miscellaneous trespass laws, both Federal and State, applicable within the national forests of this district, and a compendium of the rules of evidence, investigative methods, and criminal procedure before United States commissioner and State magistrates, together with specimen criminal forms.

Third annual report of the forestry commissioners for the year ending September 30, 1922 ([*Gt. Brit.*] *Forestry Commrs. Ann. Rpt., 3 (1922), pp. 38, pl. 1*).—This is the usual report (E. S. R., 48, p. 239) relating to forestry policies, accessions of land, and general administrative activities.

Under the subhead research and experiment it is reported that air-tight glass carboys have proved to be excellent containers in which to store Douglas fir seeds, found to keep very badly in ordinary storage. Late fall and early spring sowing of stored Douglas fir seed gave better results than late spring planting. Studies by E. V. Laing of tree growth on the peat areas of western Scotland indicate that in such types of soil good tree development is associated with adundant mycorrhiza development on the roots.

Progress reports of forest administration in the Jammu and Kashmir State for the years 1919–20 and 1920–21, B. O. Coventry (*Jammu and Kashmir [India] Forest Admin. Rpts., 1919–20, pp. II+25+LXIII; 1920–21, pp. II+27+LXVI*).—These are the usual reports (E. S. R., 46, p. 541), including data relative to activities, alterations in area, protection from fire, general silvicultural operations, exploitation, and financial statements.

DISEASES OF PLANTS.

Plant diseases (*Georgia Sta. Rpt. 1922, pp. 14–16*).—A laboratory study of *Sclerotium rolfsii* having shown its acid requirements for good growth, pot trials in progress are said to confirm this fact.

In an investigation of tobacco root rot due to *Thielavia basicola* some highly resistant strains of Sumatra tobacco have been obtained.

Tests of varieties of pears for resistance to fire blight have been in progress for about 10 years. All varieties are said to have succumbed to blight except a variety locally known as Pineapple, which seems to be quite resistant.

[Report of the Indiana Station] department of botany (*Indiana Sta. Rpt. 1922, pp. 19–23, figs. 3*).—Three lines of work are reported upon—corn-disease investigations, rust investigations, and vegetable and truck crop disease studies.

In the corn-disease investigations root rot has received most attention, and certain soil conditions are considered to influence a tendency to root rot development. Unbalanced soil nutrients are considered favorable to an accumulation of iron and aluminum resulting in the discoloration and disintegration of the nodal tissues. Inoculation experiments with *Gibberella saubinetii* in slightly acid soils gave negative results with dent corn, while sweet corn showed some infection.

In the rust studies reported attention was directed to strains of wheat resistant to leaf rust, and a considerable number have been isolated for further trial. Field studies have indicated that the aecial stage of the leaf rust of wheat may be produced in the field on susceptible hosts under favorable conditions. Investigations of the life cycle of barley leaf rust (*Puccinia dispersa*) have shown that the aecial stage is produced on *Ornithogalum umbellatum*, a plant introduced from Europe.

A study of rosette of wheat, occurring in several counties in Indiana, is said to have shown that this disease is not the take-all of Australia and elsewhere. A number of varieties of wheat have been found that are immune to rosette.

Among the miscellaneous diseases reported upon, tomato mosaic is said to overwinter on a number of related perennial weeds, among them matrimony vine, bittersweet, horse nettle, and several species of ground cherry. The eradication of these weeds from tomato fields is recommended.

For the control of the bacterial spot of tomatoes seed disinfection is said to have given good results. Infection of the fruit is claimed to be independent of wounds.

Infection by apple blotch is reported to be largely through cankers formed at leaf scars, the fungus having invaded the twigs by passing down the petiole from the leaf blade.

[Report of the Oregon Station] department of botany and plant pathology (*Oregon Sta. Bien. Rpt. 1921–22, pp. 72–74*).—Brief accounts are given of the progress on a number of investigations carried on at the station.

It is claimed that by the use of Bordeaux mixture in one of the late codling-moth sprays apple tree anthracnose can be successfully controlled and thus avoid the late fall spraying usually recommended.

Experiments on the control of onion smut are said to have shown excellent protection on heavily contaminated soil by the use of formaldehyde at the rate of 1 oz. to 1 gal. of water, provided the solution was run in a stream of not less than $\frac{5}{16}$ in. in diameter into the furrow as the seed was applied. Where this treatment was employed more than four times as large a yield of onions was obtained as from an untreated plat.

A serious outbreak of a foot rot disease of winter wheat occurred in 1921, and subsequent investigations showed that it was due to the organism responsible for the take-all disease of Europe and Australia. Preliminary investigations are thought to indicate that climatic conditions have a very great influence on the severity of the disease.

Previous experiments having shown that the ordinary formaldehyde and copper sulphate methods of treating grain for the prevention of smut, even where a subsequent bath of milk-of-lime was used, injured the seed to a considerable extent, experiments were conducted in 1922 with powdered copper carbonate. The results showed no injury to wheat with this method, and the smut control seemed to be very promising. Tests were made of 900 varieties of wheat for smut resistance, and a number of varieties were found that are being used for breeding and selection work for smut resistance.

Investigations of potato wilt are said to have shown the value of the rotation of crops and field roguing for the control of this disease. Wilt is said to spread from plant to plant during the growing season, and the removal of plants as soon as they show signs of wilt tends to check the spread of the organism, but better control is obtained by removing not only the plant showing the disease but also the next plant on either side in the row.

Investigations having revealed the early spore stage of the fungus responsible for the European canker of pears and apples, this is said to render easier the recognition of the disease. Preliminary tests have indicated that an application of Bordeaux mixture previous to the fall rainy season is distinctly beneficial for its control.

Loganberry cane die-back, which was destructive in the winter of 1921, was found to occur where the canes were allowed to lie on the damp soil during the winter season, while canes that were well trained from the ground did not suffer from this trouble. Fall training, however, is said to render the canes more subject to damage from unusually cold winter temperatures that appear occasionally.

The presence of a leaf-and-stem-infesting nematode in strawberries and other plants is reported in several counties along the coast region of Oregon. The organism has also been discovered on wild strawberries growing close to the ocean.

It is reported that the use of copper tacks, which appeared effective in the control of the common wood-rotting fungus, *Lenzites sepiaria*, did not prove effective against a number of other wood-destroying fungi. Experiments are in progress in which tests are being made of a number of air-porous wound coverings to determine their effectiveness for wood-rot prevention.

[Report of the Porto Rico Insular Station division of plant pathology], J. Matz (*Porto Rico Dept. Agr. and Labor Sta. Ann. Rpt., 1922, pp. 51–55; also in Spanish ed., pp. 48–53*).—The principal investigation reported upon is connected with diseases of sugar cane.

The gumming disease of sugar cane due to *Bacterium vascularum* is said to be spreading, and the wide planting of the very susceptible variety Otaheite is thought to be responsible for its dissemination. Tests are reported of a number of varieties of cane which were artificially inoculated with pure cultures of the organism, and marked differences in susceptibility were noted.

Experimental plantings of cane affected with mosaic were made with corn and sound cane. No healthy canes were produced, the disease gradually spread to the plantings of sound cane, but the corn remained apparently unaffected. Treating mosaic cane cuttings with hot water was without effect in reducing the disease. Light was not found to affect the infecting substance.

Some additional notes are given of the effect of cane mosaic on the host plant. It is claimed that there is a change in the nuclei and a reduction of chloroplasts in leaves showing the presence of mosaic.

During the year it was found that *Plasmodiophora vascularum*, the cause of a dry top rot and also a root rot of cane, was transmitted through diseased cuttings. Life history studies of the fungus showed that the resting spores do not germinate readily, but that the Plasmodium stage continues to grow under favorable conditions.

[Plant diseases, St. Thomas and Principe], H. C. Navel (In *Les Principaux Ennemis du Cacaoyer aux Iles de San-Thomé et de Principe. Paris: Émile Larose, 1921, pp. 78–96, 105–121, pls. 6, figs. 2*).—A chapter of this report of an agricultural and phytopathological study in the Island of St. Thomas and Principe deals with cacao cryptogamic diseases, including brown pod rot or

mildew (*Phytophthora faberi*), an attack by *Lasiodiplodia* (*Botryodiplodia*) *theobromae*, branch canker (*P. faberi*), branch dieback (excessive moisture or dryness, also *Fusarium* sp. or *Nectria* sp.), crown or basal rot (*Rosellinia* sp., *Armillaria* ? sp.), and others less prominent or dangerous, including *Phyllosticta theobromae* (*Colletotrichum* sp.), *Trametes persoonii*, *Acrostalagmus vilmorinii thomensis*, *Aspergillus delacroixii*, *Diplocladium theobromae* (*F. theobromae*), *N. albiseda* (*F. theobromae*), *Taphrina bussei*, *Hypochnus theobromae*, *Corticium javanicum*, *Colletotrichum theobromae*, and *Discella cacaoicola*.

The appendix contains notes regarding other plant drawbacks on St. Thomas, including an oil palm (*Elaeis guineensis*) disease (*Ganoderma applanatum*); insect attack; spray liquids, their preparation and application; and a brief bibliography.

Report on the work of the State Phytopathological Station at Gembloux, E. Marchal (*Bul. Sta. Phytopath. État, Gembloux, No. 1, (1920), pp. 32, pl. 1*).—Garden, field, and forest plant diseases are reported, mainly in condensed form.

Fungus diseases [of economic plants], P. J. Fryer (In *Insect Pests and Fungus Diseases of Fruit and Hops. Cambridge, Eng.: Univ. Press, 1920, pp. 481–595, pls. 12, figs. 10*).—This section of the present work, including chapters 28 to 40, deals in systematic form and alphabetical order with economic fruits and hops, their fungus diseases and the prevention and treatment of such diseases.

An abstract of the legislation in force in the British Empire dealing with plant pests and diseases up to the year 1920, compiled by E. M. Ralfs (*London: Imp. Bur. Ent., 1921, pp. 65*).—A condensed account, with index, is given in systematic form of plant pest and disease laws in force to 1920 in continental and island areas (separately treated) under British control.

Tests of plant protectives, 1920, E. Riehm (*Mitt. Biol. Reichsanst. Land u. Forstw. No. 20 (1921), pp. 47*).—A large number of protectives are indicated in connection with this work, the related publications listed numbering 138 titles.

Steam sterilization of greenhouse soil (*Indiana Sta. Rpt. 1922, p. 38, fig. 1*).—Steam sterilization of the soil of a greenhouse proved practicable for the control of nematodes, but it was found to increase the proportion of soluble salts sufficiently in some cases to cause injury.

The temperature relations of growth in certain parasitic fungi, H. S. Fawcett (*Calif. Univ. Pubs. Agr. Sci., 4 (1921), No. 8, pp. 183–232, figs. 11*).—From the results of the investigation of the temperature relations of growth in pure cultures of *Pythiacystis citrophthora*, *Phytophthora terrestria*, *Phomopsis citri*, and *Diplodia natalensis*, it is stated that in each case an optimum temperature was found. The fact is emphasized, with illustrations, that the optimum temperature for the average rate of growth of a given fungus with a given medium is not always the same for different lengths of observation periods, or when periods of equal length have different time relations to the beginning of the culture period.

Temperature relations of eleven species of Rhizopus, J. L. Weimer and L. L. Harter (*Jour. Agr. Research [U. S.], 24 (1923), No. 1, pp. 1–40, figs. 23*).—The results are given of an investigation of the influence of temperature on the germination, growth, and fruiting of 11 species of Rhizopus when grown upon an artificial medium of uniform composition.

Based upon their temperature relations, the species were found to fall within three groups. *R. chinensis* has a temperature maximum and optimum that is several degrees higher than that of any of the other species; *R. nigricans*, *R. microsporus*, *R. reflexus*, and *R. artocarpi* have a low optimum and

maximum; and *R. tritici*, *R. nodosus*, *R. delemar*, *R. oryzae*, *R. arrhizus*, and *R. maydis* form an intermediate group.

In general, the spores were found to germinate at a temperature above the maximum for continued growth. The optimum for germination for all the species was found to be higher than for growth and fruiting. The temperature at which the spores are produced was found to influence to some extent their rate of germination and the early period of the growth of the mycelium.

[Notes on some cereal diseases in Kentucky] (*Kentucky Sta. Rpt. 1922, pt. 1, pp. 27, 28*).—The presence of *Helminthosporium* sp. in from 25 to 50 per cent of the samples of grain investigated is reported. *Macrosporium* sp. and what appears to be *Sclerotium* sp. were present in less proportion. It is claimed that the hyphae of fungi may be present in any of the seed coat layers of apparently healthy grains of corn. Tests covering three years are said to indicate that selection of so-called badly diseased ears and disease-free ears have been without result in reducing or increasing the yield of corn, while the selection of extremely smooth ears and extremely rough ears from a lot of Boone County White corn resulted in an increase of 39 per cent in favor of the smooth ears.

During 1922 a disease of wheat was observed which caused premature ripening. The straw broke badly and the grain was shrunken. *Helminthosporium* sp. and *Gibberella saubinetii* were consistently isolated from the broken joints. A variety of wheat, Ashland, recently developed by the Kentucky Station, seemed to be particularly affected. The spring application of fertilizers to wheat fields is considered to stimulate a rank growth which results in disease attacks.

A severe infection of Helminthosporium or joint rot of wheat, E. Bassi (*Italia Agr., 58 (1921), No. 10, pp. 298–301, figs. 2*).—A node rot of grain supposedly not very prevalent in Italy is due to a fungus apparently identical with *H. gramineum*. It is not identical with the rot or spot produced by *Cladosporium herbarum*, but may be associated with forms of Fusarium or Septoria.

Foot rot of wheat caused by the fungus Helminthosporium, C. O. Hamblin (*Agr. Gaz. N. S. Wales, 33 (1922), No. 1, pp. 13–19, pls. 2, figs. 3*).—Wheat crops in widely separated regions of New South Wales showed in 1922 a disease causing damage estimated at from 2 to 3 per cent up to 85 or 90 per cent of the crop and revealing invariably the presence of the take-all fungus (*Ophiobolus graminis*) or the foot rot fungus (*Helminthosporium* sp.), associated with conditions closely similar to take-all. A full account is reserved for later publication, the present account being confined mainly to the practical aspects looking directly to control.

Flag smut of wheat with special reference to varietal resistance, W. H. Tisdale, G. H. Dungan, and C. E. Leighty (*Illinois Sta. Bul. 242, abs. (1923), pp. 4, fig. 1*).—A brief summary is given of the principal facts published in detail in the complete bulletin (E. S. R., 49, p. 343).

[Investigations by the Georgia Station of leaf rust of wheat and crown rust of oats] (*Georgia Sta. Rpt. 1922, pp. 4, 5*).—The season of 1921–22 is said to have been specially favorable to the occurrence of leaf rust (*Puccinia triticina*) on wheat and *P. coronata* on oats. In the plant breeding work at the station great variation in susceptibility to rust was noticed in different varieties and strains, some appearing quite resistant, and further study is in progress to determine the degree of resistance of the more promising strains. Similar work is in progress regarding resistance of oats to crown rust.

Yellow berry in wheat (*Oregon Sta. Bien. Rpt. 1921–22, p. 58*). Experiments carried on at the Moro Substation indicated that plats that were cultivated in such a manner as to stimulate the activity of nitrifying bacteria

produced a crop with the lowest percentage of yellow berry, the amount of available nitrogen thus appearing to be a factor in connection with this condition in wheat.

Fungi internal to Missouri seed corn of 1921, B. B. BRANSTETTER (*Jour. Amer. Soc. Agron., 14 (1922), No. 9, pp. 354–357*).—One of the first tasks undertaken in the study of corn root rot at the Missouri Experiment Station in 1921 was to make a state-wide survey of the fungi internal to the seed corn. Samples were received from 49 counties, including all the leading corn-growing counties in the various sections of the State.

The survey shows that Missouri corn of that year was heavily infected with *Fusarium moniliforme*, *Cephalosporium sacchari*, and *Diplodia zeae* in the order named, that kernels of many ears were infected with two species of the above-named fungi, and that with a little care one can select comparatively disease-free ears from a lot of corn, thus eliminating the necessity of using the germinator as a means of detecting heavily infected seed ears.

Common smuts and their treatment, A. DAANE (*Oklahoma Sta. Circ. 52 [1923], pp. 3*).—Popular descriptions are given of some of the common smuts of corn, sorghum, oats, wheat, and barley, and directions are given for their control.

Peronospora attacking alfalfa, C. CAMPBELL (*Ann. Bot. [Rome], 15 (1922), No. 4, pp. 283, 284*).—*Medicago sativa* from Argentina when about 10 cm. high showed a leaf dry spot associated with the presence of *P. trifoliorum*.

Influence of soil temperature and soil moisture upon the Fusarium disease in cabbage seedlings, W. B. TISDALE (*Jour. Agr. Research [U. S.], 24 (1923), No. 1, pp. 55–86, pls. 2, figs. 10*).—Field observations and experiments having shown a close relationship between the temperature and moisture of soils and the resistance of cabbage to yellows due to *F. conglutinans*, the author carried on at the Wisconsin Experiment Station a series of experiments with cabbage seedlings and cultures of the organism to determine the range of temperature and humidity for the growth of both the host and parasite.

The fungus grew in cultures at temperatures of from 7 to 35° C. with an optimum of 25 to 27°. The host plants grew at temperatures of from 14 to 38° with an optimum of about 20°. Cabbage yellows developed in seedlings in sick soils at temperatures ranging from 17 to 35°. With constant favorable temperature yellows developed at any percentage of soil moisture that permitted the growth of cabbage seedlings. A soil moisture content of about 19 per cent was found most favorable for the growth of cabbage seedlings when the soil temperature was held at 23°. Individual variations were noted not only for seedlings of susceptible varieties but also for seedlings of resistant varieties.

The relations between soil temperature and moisture are considered of significance in the geographical distribution of the disease. In the Southern States, where cabbage is grown commercially as a winter or early spring crop, the soil temperature is believed to be too low for the organism to gain a foothold on such plants. On the other hand, when the Fusarium has become established growing cabbage as a summer crop may be expected to result in diseased plants whenever soil temperature is favorable.

The author found that the degree of resistance shown by a strain of cabbage depends to a considerable extent upon the environmental conditions under which the plants are grown. In his experiments all plants remained healthy in sick soil where the temperature was below 17°. Many were resistant at from 17 to 23°, and a small number were resistant at the higher temperatures. Fusarium resistance in cabbage was found to become more pronounced with increasing age of the plant. Young seedlings of a highly resistant strain

developed a high percentage of yellows when started in sick soils at high temperatures, while plants grown for 30 days or more in noninfested soil, or even in sick soil below 17°, when transferred to sick soils at high temperatures developed only a low percentage of yellows.

These facts are considered of practical significance as indicating the performance of resistant strains of cabbage. It is believed the strains will give the best results commercially when started in a noninfested seed bed during cool weather, and this is said to accord with the best practice of commercial cabbage growers in the Northern States. Under such conditions it is believed that resistant strains may be safely recommended for trial in Fusarium sick soils, but the resistance may be expected to break down to some degree proportional with the elevation of temperature.

Clover [root rot] in Kentucky (*Kentucky Sta. Rpt. 1922, pt. 1, p. 29*).—The results are briefly given of a study of stands of red and alsike clover on unproductive or clover-sick soil. Root rot was present to some extent on all of the root systems examined, and such roots were practically destroyed by the end of the first summer. The taproot systems of clover plants on other soils functioned throughout the first and part of the second summer, but were badly diseased or dead by the end of the second summer.

The browning and stem break disease of cultivated flax (Linum usitatissimum), caused by Polyspora lini, H. A. Lafferty (*Roy. Dublin Soc. Sci. Proc., n. ser., 16 (1921), No. 21–24, pp. 248–274, pls. 3*).—The recent large increase in flax cultivation in Ireland was followed by numerous instances of partial or total crop failure, due in some cases to specific diseases caused by parasitic organisms. This fact led to the initiation of a program for the scientific investigation of flax diseases. A general account of the work undertaken and of the results so far obtained has been noted (E. S. R., 48, p. 46).

The present paper deals with another previously unrecognized disease of flax which has been proved to be due to a fungus hitherto undescribed, and in which a general browning of the crop and fracture of many of the stems are characteristic features. Apparently the disease has not been described for any other country, though it occurs in Ireland on flax grown from Dutch seed more frequently than on those from seed of other origin. The fungus has been found on seed from crops grown in England and Scotland and perhaps in Belgium. It has appeared in Ireland on crops from seed supposed to have been raised in England, Scotland, Holland, Russia, Canada, and Japan, and it is believed to be present in British East Africa.

The disease manifests itself in two principal forms for which the terms "browning" and "stem break" are suggested as suitable. These are described, as are also the histological features, details of the fungus itself, and the isolation of the fungus and its behavior in pure cultures. The fungus is described as *P. lini* n. g. and n. sp., and an account is given of the proof of its pathogenicity, the transmission of the disease, and plans for its control.

Diseased plants produce infected seed, and it was proved that the transmission of the disease occurs through sowing such seed. It is regarded as probable that this is the chief or only means by which the disease is perpetuated. Both white-flowered and blue-flowered flax varieties are susceptible.

Lettuce root rot and tipburn (*Kentucky Sta. Rpt. 1922, pt. 1, pp. 38, 39*).—This reports tests of several lots of apparently normal lettuce seeds for seed-borne organisms. In some lots nearly every seed appeared to be infected with a species of Macrosporium. Other lots of seed apparently free from infection when examined under a microscope showed the presence of a fungus much smaller than the Macrosporium between the seed coats. It is believed that this

is an unidentified organism that may be the cause of lettuce root rot, and that tipburn is a secondary effect of this trouble.

Potato disease: Its prevention and cure (*Fruit, Flower, and Veg. Trades' Yearbook, 1921, pp. 9, 11*).—During six years the saving of the potato crop due to the employment of spraying amounted to 2.5 tons per acre. A 2 per cent Burgundy mixture is recommended. Subsidiary measures indicated include seed selection, removal and destruction of above-ground portions before digging the tubers, thorough banking of the potato rows to prevent access of spores, and dipping seed tubers in corrosive sublimate.

Spray v. dust for potato blight (*Rhode Island Sta. Bul. 193 (1923), p. 4*).—In comparative experiments with Bordeaux mixture applied as a spray and as a dust for the control of potato late blight in a season especially favorable to the disease, the yield from the dusted plats is said to have been only about 70 per cent of that where the fungicide was applied as a spray.

Observations and experiments on the leaf roll disease of the Irish potato in Japan, M. Kasai (*Ber. Ōhara Inst. Landw. Forsch., 2 (1921), No. 1, pp. 47–77*).—In June, 1919, attention was drawn to a serious potato disease prevalent in several parts of Okayama prefecture, where it is known as the shashaki disease from the similarity of the diseased potato plants, as regards rigidity and discoloration, to a local shrub bearing this name. Though the actual cause of the disease has not yet been fully determined, it is noted that tubers produced by affected plants give rise to diseased plants the following season. The disease has only been recently recognized in Japan, but it is already fairly prevalent and is increasing. The disease is transmitted by insects (also experimentally by tuber graftings and juice injection), though not through the soil, and is considered as identical with leaf roll in other countries.

Mosaic disease of potatoes (*Kentucky Sta. Rpt. 1922, pt. 1, pp. 37, 38*).—In continuation of investigations on mosaic diseases of potatoes (E. S. R., 48, p. 146), in which the main crop was grown from tubers a test of which had shown they were free from mosaic, tubers from the crop of 1921 were planted in 1922, and no mosaic appeared in any of the spring planted hills. This experiment is believed to indicate that mosaic was completely eliminated in two seasons from seed stocks which at the beginning had been infected in varying degrees of from 2 to 95 per cent.

Report of the special pathologist, C. E. Chardón (*Porto Rico Dept. Agr. and Labor Sta. Ann. Rpt., 1922, pp. 61–68; also in Spanish ed., pp. 67–74*).—A report is given of the influence of various factors on the spread of sugar cane mosaic in the field.

Definite correlations were found to exist between the rainfall and the spread of disease and also the age of the plant and the progress of the disease. Variations of temperature did not appear to influence infection. The idea is advanced that most of the transmission of disease is by aphids whose normal hosts are weeds, only a portion of their life being spent on sugar cane. The presence of such weeds is considered a menace to cane fields. The direction of the secondary spread of the disease is said to follow that of the prevailing winds. It is reported that the percentage of infection is low in fields near the sea, and the hypothesis is offered that salt in spray is deposited on the leaves and acts as a repellent to the insects that transmit the disease. There is also an absence of the weeds that are the usual hosts of the cane insects that are connected with cane mosaic.

[**Tobacco disease investigations in Kentucky**] (*Kentucky Sta. Rpt. 1922, pt. 1, pp. 22–24*).—Continued tests are reported of a strain of Burley tobacco that showed a resistance to root rot (*Thielavia basicola*). Another strain re-

cently developed proved resistant to the fungus, but it was of an undesirable type. A number of other selections are said to be under test.

A test is reported of nine varieties of dark tobacco for resistance to root rot. One variety proved quite resistant, but it is considered of doubful value. Another showed a fair degree of resistance and is of good quality. Turkish tobacco proved almost immune.

A study was made of the mosaic disease of tobacco, and it was found to be carried over winter on the bull nettle and several species of ground cherry which are common weeds in tobacco fields in Kentucky. Experiments were conducted to eradicate these weeds by spraying them with crude oil and gasoline, but they resulted in failures, as only the tops were injured and new shoots soon appeared from the rootstocks. Attempts to transfer the mosaic disease of beans, red clover, soy beans, and pokeweed to tobacco gave negative results.

Control measures for wildfire and angular spot (*Va. Dept. Agr. and Immigr. Leaflet 5 [1921], pp. 4, figs. 2*).—This material, prepared by F. D. Fromme on the basis of work done by him and S. A. Wingard, shows that during four seasons tobacco diseases have caused much loss in Virginia, due mainly to wildfire and angular leaf spot, caused, respectively, by *Bacterium tabacum* and *B. angulatum*. The problem of control centers in the plant bed, infection originating usually from the seed, the cover, or the soil, the first being the most important, though the organisms had not been shown to overwinter in the plant bed. Both seed pods and leaves are infected. Seed treatment involves the use of formaldehyde, 1 oz. (of the 40 per cent solution) to 1 pint of water, thorough washing and drying, after which the seed will keep safely for several months.

A spot of pickled tomatoes, M. Kufferath (*Bul. Soc. Roy. Bot. Belg., 54 (1921), pp. 190–194*).—A spot of pickled tomatoes (*Lycopersicum esculentum*) showed by direct microscopic examination the presence of a microorganism which is regarded as a new species and has been named *Bacterium puttemansi*.

Apple blotch control (*Indiana Sta. Rpt. 1922, p. 37*).—Apple blotch is said to have been controlled in an orchard of Northwestern Greening by three applications of Bordeaux mixture. The experiment on the control of apple blotch has been extended to include other fungicides and the variety Duchess of Oldenburg.

A study of the internal browning of the Yellow Newtown apple, A. J. Winkler (*Jour. Agr. Research [U. S.], 24 (1923), No. 2, pp. 165–184, pl. 1, figs. 2*).—The results are given of an investigation carried on by the California Experiment Station to determine the cause of internal browning, with special reference to field conditions which are responsible for the susceptibility of the fruit and the internal and external factors which are immediately responsible for its development in storage.

Internal browning is considered a nonparasitic disease of the large isodiametric cells of the flesh of the fruit. Apples of the variety Yellow Newtown, regardless of where grown, are susceptible to internal browning, and under the conditions prevailing in the Pajaro Valley this variety has proved to be much more susceptible than when grown in other regions. The later the fruit was picked, the greater the amount of browning was found to occur in storage. No browning occured at the expiration of six months' storage in any of the fruit stored at 8.3° C. or above. A limited amount of browning was observed at the end of six months' storage at a temperature of 5°, but at 2.2° approximately 70 per cent of the apples showed browning. At 0° practically all the fruit was browned before the first of April.

In experiments carried on in the orchard, where the temperature was lowered to 3° by tenting or shading a tree, susceptibility to browning was greatly increased. When the temperature was increased by 4° by bagging individual apples in black cloth during the growing months, increased resistance to the disease was noted.

In storage browning was greatly reduced by ventilating the fruit, and wrapping it in wrappers which were good absorbents of essential oils also reduced the browning. The author concludes that internal browning is due to the accumulation of essential oils or similar deleterious substances which are produced by the apples in storage.

Apple measles (*New Mexico Sta. Rpt. 1922, pp. 13, 14*).—It is reported that all attempts made at the station to isolate an organism responsible for the apple tree disease known as measles and efforts to transmit the disease by inoculation resulted in failures. Attempts to graft healthy scions upon roots of diseased trees failed to grow due, it is believed, to the weakened condition of the roots.

Black spot of pear and apple, W. LeG. Brereton, C. O. Hamblin, and W. B. Stokes (*Agr. Gaz. N. S. Wales, 33 (1922), No. 2, pp. 123–130, figs. 3*).—Experiments were conducted for three years for the control of pear black spot. A series of sprays for the control of apple black spot was carried out in 1920–21. As a result of the experiments here detailed, the department offers recommendations regarding control measures for these two diseases.

[Studies of pear blight in Oregon] (*Oregon Sta. Bien. Rpt. 1921–22, pp. 95–97*).—The principal work at the Southern Oregon Substation is said to be connected with the study of blight resistance in pears. In order to carry on this investigation a large collection of varieties cultivated in this country, as well as cultivated varieties from Europe, China, and Japan, and wild species from Europe, Asia, and Africa, are being tested. While nearly all have proved susceptible to blight, a small percentage of resistant types have been found which are being studied to determine their value as blight-resistant stocks on which to graft commercial varieties.

In connection with blight work tests were made of corrosive sublimate and cyanid of mercury for disinfection of wounds and tools. Neither material proved absolutely effective when used alone, but a combination of the two was found to be highly satisfactory for the disinfection of both wounds and tools.

Pear spraying investigations (*Oregon Sta. Bien. Rpt. 1921–22, pp. 88, 89*).—Experiments carried on at the Hood River Substation are said to have shown that certain varieties of pears are much more susceptible to spray injury than others. The variety Anjou can not be sprayed with lime sulphur after the delayed dormant spray without causing severe russeting.

Some studies on the Pseudomonas pruni, K. Kuwatsuka (*Ann. Phytopath. Soc. Japan, 1 (1921), No. 4, pp. 12–19*).—Studies dealing with inoculation experiments on plum fruits, susceptibility of rosaceous plants to *P. pruni*, and the influence of soil moisture upon infection are outlined. The data are presented partly in tabular form.

Bramble fruit diseases, H. P. Barss (*Oregon Sta. Circ. 45 (1923), pp. 10–16, figs. 6*).—The author describes anthracnose, crown gall, raspberry rust, orange rust, winter injury, bud blight of loganberry vines, difficulties due to unsatisfactory soil conditions, drought, etc.

Running-out of raspberries, W. H. Rankin (*New York State Sta. Circ. 67 (1923), pp. 12*).—According to the author, three infectious diseases are recognized as causing the running-out of raspberry varieties. These are mosaic, leaf curl, and rosette. Each of the diseases is described at some length, and for their control roguing during a dry season is recommended. Two roguings are

considered advisable for the control of red raspberry mosaic. The first should be made as soon as the symptoms show plainly on the suckers, and the second in August, immediately following a protracted period of hot weather if possible. The success in controlling mosaic will depend upon the accuracy in picking out the infected plants and the degree of care taken in the removal of all affected parts. Roguing the bushes affected by leaf curl should be done as soon in the spring as they can be detected and again in August.

Diseases of currant and goosberry, H. P. BARSS (*Oregon Sta. Circ. 42 (1923), pp. 8–12, figs. 5*).—Descriptions are given of powdery mildew, anthracnose, and die-back of currant and gooseberry, and suggestions are given for their control. The relation of currants to the white pine blister rust is indicated.

On a disease of the grape cluster caused by Physalospora baccae, Y. NISHIKADO (*Ann. Phytopath. Soc. Japan, 1 (1921), No. 4, pp. 20–42, pl. 1*).—Studies during 1914–1916 on the causal organism of a grape cluster disease were applied chiefly to morphological characters of the pycnidium, pycnospore, perithecium, ascus, and ascospore. The disease has been prevalent in a few areas indicated for about 10 years or more. It attacks the peduncle, pedicel, and berry of *Vitis vinifera*, but neither the leaf nor stem. The pycnidial form is said to be identical with *Macrophoma reniformis*, causing the so-called black rot in the Caucasus. The perithecial stage is identical with *P. baccae* (*Guignardia baccae*).

Citrus canker eradication department, W. NEWELL (*Fla. Plant Bd. Quart. Bul., 7 (1923), No. 2, pp. 87–95, figs. 2*).—There has been no recurrence of the citrus canker outbreak previously noted (E. S. R., 47, p. 153), but an almost similar situation was discovered at Davie in Broward County, fortunately a somewhat isolated area. In 1915, a few infected trees had been found and destroyed in this neighborhood, the disease apparently being stamped out and repeated inspections showing no disease until May, 1922. At this time 216 trees were found infected in a grove at Davie, and search located 14 properties having 753 infected trees. There has been no spread from these areas. The disease is thought to have held over from 1915 in some tree or in the soil.

A detailed and partly tabular review is given of the citrus canker eradication work as a whole and of its results to June 30, 1922. This is extended in the report noted below.

Report on [citrus canker] eradication work in cooperation with the Bureau of Plant Industry, for quarter ending December 31, 1922, W. NEWELL (*Fla. Plant Bd. Quart. Bul., 7 (1923), No. 2, pp. 145, 146*).—This summary (see above) shows that up to December 31, 1922, citrus canker has been found in 22 Florida counties; grove trees infected, since May, 1914, 15,140; nursery trees, 342,260; properties, 509; properties no longer danger centers, 486; and properties still classed as infected, 23.

Tabular figures show no infection since August, 1920, until in May, 1922, 585 were noted, and in June 168, the number reducing to 4 in December, 1922.

Control of collar rot of citrus trees, C. O. HAMBLIN (*Agr. Gaz. N. S. Wales, 33 (1922), No. 4, pp. 294–296, fig. 1*).—Citrus trees showing collar rot constantly associated with a Fusarium and with certain unfavorable conditions were treated with bluestone paint or bluestone paste (directions for making which are given), and showed about equally good results from both when the work was done early and carefully, with inspection to prevent recurrence from diseased spots overlooked.

[Coffee diseases] (*Bul. Agr. [Sao Paulo], 22. ser., No. 11–12 (1921), pp. 330–332*).—Coffee planters near Piratininga suffer loss from a disease attacking

the trees, in connection with which were found *Alternaria tenuis*, *Phoma* sp., and *Fusarium* sp.

Chlorosis (*New Mexico Sta. Rpt. 1922, p. 14*).—An account is given of an attempt to control chlorosis of cottonwood trees by injecting into the cambium layer pure iron sulphate. The first effect of the injection was the complete shedding of the leaves. Later all trees recovered and put forth new leaves which were nonchlorotic. Late in the summer the trees again showed evidence of chlorosis, although all the iron sulphate had not been dissolved by the sap. It is considered that this treatment gave only temporary relief, and that the cause of chlorosis must be something other than the lack of iron.

It is concluded that this disease is not a specific one but merely an indication of impending death due to a number of causes, such as lack of water or too much water, too high temperature, too much alkali, etc.

An important root disease on Borneo camphor, F. W. South (*Agr. Bul. Fed. Malay States, 9 (1921), No. 1, pp. 34–36*).—A root disease causing the death of Borneo camphor (*Dryobalanops aromatica*) is found to be due to *Rosellinia bunodes*, reported from other places named in that part of the world. The fungus sometimes begins its attack from a decaying jungle stump, but it may also spread from heaps of damp leaves and twigs. The treatment recommended is much the same as for other traveling root diseases, namely, effective trench isolation.

Brown bast, A. R. Sanderson and H. Sutcliffe (*London: Rubber Growers' Assoc. (Inc.), [1921], pp. 71, pls. 26, figs. 9*).—A description is given of the bark and cortex of rubber trees affected with brown bast, such as is expected to enable managers and assistants to identify the trouble with comparative ease, especially in the middle or latter stages. Special emphasis has been laid on early treatment of diseased tissue. The view is provisionally held that the trouble is physiological and due to tapping operations. Stripping, here recommended as a check and cure for brown bast, is regarded as likely to prove effective and not too drastic.

A willow canker disease caused by Physalospora miyabeana and its conidial form Gloeosporium, T. Fukushi (*Ann. Phytopath. Soc. Japan, 1 (1921), No. 4, pp. 1–11, figs. 8*).—In 1919 and 1920 a canker on the Japanese osier (*Salix purpurea angustifolia*) appeared near Sapporo. The disease is thought to be present in Hokushu. It is caused by *P. miyabeana* n. sp. and its conidial form *Gloeosporium* sp., the relations between the perithecial and the conidial stages having been established by cultural experiments.

ECONOMIC ZOOLOGY—ENTOMOLOGY.

The organization of international measures for protection against insect pests, R. Maynė (*Ann. Gembloux, 28 (1922), No. 10, pp. 325–339*).—This is a discussion of the means of preventing the dissemination of insect pests.

[Report of the Indiana Station] department of entomology (*Indiana Sta. Rpt. 1922, pp. 28–31, figs. 2*).—In the course of this brief report of the work of the year, it is stated that further experiments with paradichlorobenzene have shown no injury to peach trees, not even when 1-year-old trees were treated, and the entomologist feels justified now in recommending it for use on trees younger than 6 years. The flower thrips has made its appearance in threatening abundance on the peach, attacking the forming fruit, disfiguring it and making it unmarketable. This thrips injury, which first became apparent in 1921, was much more severe in 1922, while the codling moth was much less injurious than usual in 1922. With the rapidly increasing acreage of the soy bean, which has in the past been practically free from insect pests, the clover root curculio (*Sitona hispidulus*) has made its appearance. This pest destroys

the young plants by eating the buds and riddling the foliage, but only when the crop follows clover, and a rotation in which soy beans do not follow clover is indicated as a control measure.

[Economic insects in Kentucky] (*Kentucky Sta. Rpt. 1922, pt. 1, pp. 40, 41*).—It is reported that the use of paradichlorobenzene for the control of the peach borer has proved highly effective, with nearly 100 per cent elimination of the borers. The Mexican bean beetle made its appearance in southern Kentucky, having been reported in June from Monticello and Coopersville and has since spread northward and westward toward the central part of the State.

[Report of the Oregon Station] department of entomology (*Oregon Sta. Bien. Rpt. 1921–22, pp. 75–79, 88*).—In reporting upon a study of the physical improvement of the spray solution and its effect on the toxicity of the insecticide, calcium caseinate for use as a spreader and oil emulsions are briefly dealt with.

Tests with commercially prepared calcium caseinate and similar material prepared in the laboratory indicate that "(1) the addition of the caseinate spreader in combination sprays of lead arsenate lime sulphur materially delays the reaction between the two materials with the attendant formation of the undesirable sludge. (2) Caseinate spreaders in the late cover sprays on apple, by effecting a smooth, even covering of the spray over the fruit surface, minimize the uneven coloring of the highly colored varieties of fruit, so undesirable and almost sure to occur where a blotchy spray covering is given. (3) In general, by effecting a more rapid covering and wetting of the sprayed surface, the addition of caseinate spreaders tends to increase the number of trees covered per tank of spray. (4) In toxicity tests carried out with caterpillars, no evidence was found to substantiate the theory that the addition of caseinate spreader adversely affects the toxicity of the arsenate spray." A number of emulsions were prepared from various animal and vegetable oils, saponin solution giving the best results as an emulsifier.

The results of work with important pests during the year are briefly referred to. Codling moth studies resulted in the issuance of recommendations for the timing of the applications, with an estimated saving of at least 8 per cent of the crop of the Hood River Substation district. In investigations of sprays for the eggs of leafrollers, sprays consisting of combinations of oil emulsions, 5 per cent oil, with lime and glue, gave best results.

[Report of the South Dakota Station] department of entomology, H. C. Severin (*South Dakota Sta. Rpt. 1922, pp. 17–21*).—This report briefly summarizes the status of investigational work on two Adams fund projects. The first relates to the distribution, life history, economic importance, natural enemies, and control of the common field cricket (*Gryllus assimilis* Fab.). A list is given of six parasites and three predatory enemies of this pest. The second relates to similar studies of the wheat stem maggot (*Meromyza americana* Fitch), which has been found to have three broods in the region of Brookings, the bulk of the flies appearing from late May to early in June, from July 4 to August 10, and from the last of August through September. The two most important parasites reared from wheat stems infested with the wheat stem maggot are *Microbracon meromyza* Gah. and *Coelinidea meromyza* Forbes.

Annual report of the division of entomology for the fiscal year of 1921 to 1922, G. N. Wolcott (*Porto Rico Dept. Agr. and Labor Sta. Ann. Rpt., 1922, pp. 44–49; also in Spanish ed., pp. 55–60*).—In control work with white grubs (*Lachnosterna* spp.) only 70 per cent of the full-grown grubs of the largest Porto Rican species, *L. vandinei* and *L. portoricensis*, were killed when cyanid dissolved in water was used at the rate of 500 lbs. per acre. Since second instar grubs of a smaller species, *L. citri*, suffered a mortality of 70

per cent from the use of cyanid at the rate of 100 lbs. per acre, experiments will be continued with the second instar larvae.

Negative results were obtained in an attempt to transmit the gumming disease of sugar cane by caterpillars of the sugar cane borer, fall army worm, and *Cirphis latiuscula* H. S. Similar results were obtained in the attempted transmission of mosaic disease of sugar cane by the common leafhopper *Kolla similis* Wlk. and with aphids.

In the coffee insect survey work, several new pests were discovered, including a new termite, *Glyptotermes pubescens* n. sp.; two crickets, *Grillacris* sp. and *Stenogryllus* sp.; a pentatomid bug, *Edessa affinis* Dal.; a brown fulgorid, *Cyarda* sp.; the tree hoppers *Antianthe expansa* Germar and *Monobelus fasciatus* Fab., and two others unidentified; a large brown moth, *Letis mycerina* Fab.; a small blue coccinellid, *Psorolyma maxilosa* n. sp., and a large brown one, *Daulis ferruginea* Oliv.; a little yellow ant, *Iridomyrmex melleus* Wh.; and *Macromischa isabellae* Wh. The otiorhynchid beetle feeding on young coffee leaves has been described by G. A. K. Marshall as *Lachnopus coffeae* n. sp., and the variety found around Adjuntas as *L. coffeae montanus* n. subsp. The coffee shade-tree ant, *Myrmelachista ambigua ramulorum* Wh., is probably the most injurious insect to coffee in Porto Rico, numerous control experiments having been carried on and will be continued.

Following the discovery of the pink bollworm in Porto Rico in July, 1921, a survey was made which showed it to occur all around the island near the coast, except around Mayaguez, but it has not been found in the interior, even a few miles from the ocean. The banana root-borer was first received from Vega Baja on December 1, 1921, and was later received from Corozal and recorded from Guaynabo.

A new type of light trap for insects, C. B. Williams (*Egypt Min. Agr., Tech. and Sci. Serv. Bul. 28 (1923), pp. 2, pls. 2*).—The author presents a description and drawings of an efficient portable light trap invented for use in field work with cotton pests in Egypt.

Studies on contact insecticides, C. H. Richardson and C. R. Smith (*U. S. Dept. Agr. Bul. 1160 (1923), pp. 16*).—This is a report of laboratory studies of the effect of a number of organic compounds as contact insecticides for *Aphis rumicis* L. living on nasturtium plants.

"Pyridin, alpha picolin, and commercial pyridin containing the higher homologues of pyridin were of little value as contact insecticides. The alkaloids, with the exception of nicotin, were of low toxicity. Nicotin, however, was the most toxic compound investigated (excluding 'pyrethron'). The aliphatic amins and substituted ammonium compounds showed considerable toxicity. Tetramethylammonium chlorid was the most toxic, methylamin hydrochlorid the least. Of the two cyclic amins, benzylamin was five times as toxic as anilin. The aliphatic aldehydes and ketones had a low order of toxicity. Benzaldehyde was moderately toxic.

"The aliphatic alcohols showed little toxicity. Benzyl alcohol, a cyclic compound, was more toxic. Cresol U. S. P. was the most toxic of the phenols, pyrogallol the least, while phenol and resorcinol occupied an intermediate position. The esters of cyclic compounds showed some toxicity. Sulphonic acids and their salts had little effect. Picric acid and sodium salicylate showed appreciable toxicity. Fish-oil soap (sodium base) was relatively ineffective. Benzene, toluene, and xylene were only slightly toxic. Aliphatic compounds containing chlorin were but slightly toxic; benzene derivatives containing chlorin were much more toxic. Essential and fixed oils showed some toxicity.

"Piperidin as the sulphate and trimethylamin as the hydrochlorid, when applied in dilute soap solution, were more toxic than the respective free bases.

Nicotin as the sulphate and nicotin base were of approximately equal toxicity. Pyridin and its homologues as found in commercial pyridin, alkaloids, sodium phenol sulphonate U. S. P., aliphatic aldehydes and ketones, and aliphatic alcohols of low molecular weight were relatively nontoxic to the nasturtium plant. Most of the other compounds used in this investigation had considerable toxicity.

"Neither the volatility nor the boiling point is a reliable index of the toxicity of organic compounds when used as contact insecticides. Chemical structure does not appear to be a dependable index of toxicity. Nevertheless, it is probably the best empirical guide at present available for the study of contact insecticides."

A list is given of 14 references to the literature cited.

Factors which affect the volatility of nicotin from insecticide dusts, R. W. THATCHER and L. R. STREETER (*New York State Sta. Bul. 501 (1923), pp. 3–34*).—This is a report of investigations conducted in order to determine the principles which govern the volatility of nicotin from various insecticide dusts under varying conditions of storage and use.

The experiments have clearly shown that "in their relations to other substances which may react upon them, nicotin compounds are analogous to ammonium compounds; the free alkaloid and its hydroxid, carbonate, sulphate, chlorid, etc., in their solubilities and their volatility from solutions and from dry dusts are perfectly parallel with free ammonia and ammonium hydroxid, carbonate, sulphate, etc. Therefore, it is possible to predict accurately from the known properties of ammonium compounds how nicotin compounds will react with other agencies and under varying conditions of moisture, temperature, etc. In their effect upon the volatility of free nicotin, the various commercial materials which may be utilized in the manufacture of insecticide dusts may be classified into two groups, namely, those which are 'adsorbent,' i. e., tend to prevent the volatilization of nicotin, and those which are 'inert,' i. e., have no effect upon the volatility of the nicotin other than to expose large surfaces for its evaporation. Kaolin, kieselguhr, and talc represent the first type, while other substances which have been suggested for use as carriers in insecticide dusts are inert in their effect upon free nicotin. The efficiency of all dusts of the latter type in volatilizing free nicotin is increased in proportion to the fineness to which they are ground and is diminished by the presence of moisture, as the latter tends to dissolve the free alkaloid and so prevent its volatilization.

"With commercial solutions of nicotin sulphate, the various common carriers are of three different types in their effect upon the volatility of dusts made from them. The first type, which includes such colloidal substances as kaolin, kieselguhr, and talc, are adsorbent, i. e., tend to prevent volatilization. The second, including most of the common crystalline powders, such as gypsum, sulphur, slate dust, etc., are inert, their only effect being to expose the nicotin sulphate over larger surface areas for evaporation. The third, which includes all the common hydrates and carbonates—hydrated lime and carbonate of lime being the ones commonly used—are 'active,' in that they change the nicotin sulphate into more volatile forms. The change produced by these active carriers is dependent upon the presence in the mixture of a small amount of water, such as is usually supplied by the water in the commercial solutions of nicotin sulphate. Too much water slows up the volatility of the nicotin from these dusts by dissolving it, as well as interfering with the dust properties of the mixture.

"When tobacco dust is used as the source of the nicotin, none of the common carriers except hydrated lime has any effect upon its volatility. Hydrated lime, however, does increase the volatilization of the nicotin from tobacco

dust by its action upon the tissues in which the nicotin is held in the tobacco and the conversion of the nicotin which the tissues contain into more volatile form. This effect is increased by the presence of sulphur in the dust mixture, but in this case heat is generated and there is danger that the mixture may catch fire. Carbonate of lime and other carbonates, such as dolomite or carbonate of magnesia, is the most efficient and most easily controlled of the active type of carriers for nicotin sulphate dusts.

"Most nicotin dusts will probably be more efficient if applied to foliage when it is dry, as the presence of water generally tends to reduce the volatility of the nicotin in the gaseous form in which it accomplishes its toxic effect upon insects. Nicotin-containing materials may be mixed with other insecticidal and fungicidal dusts without impairing the volatility of their nicotin, except in the case of those dusts which contain anhydrous copper sulphate. In the latter case, the copper compound takes up the moisture that is necessary to the change of nicotin into its more volatile forms, and the mixture 'cakes' and loses its dust properties if enough water is added to facilitate the proper change in the nicotin. Hydrated lime and sulphur dusts increase the volatility of nicotin from its compounds very markedly, but the mixtures must be carefully handled to prevent generation of heat to a dangerous degree. Dusts containing nicotin in its most actively volatile forms lose strength rapidly in storage unless kept in tightly closed containers, completely filled, and even under these conditions some loss of nicotin may be expected if the dust contains either hydrate or carbonate of lime, or any similar compound."

The aphiscidal properties of tobacco dust, G. F. MacLeod and S. W. Harman (*New York State Sta. Bul. 502 (1923), pp. 3–18, pls. 3*).—This is a report of investigations of the toxicity of tobacco dust to the green peach aphid *Myzus persicae* Sulz, a pest particularly abundant on blue spirea (*Caryopteris mastacanthus*) in greenhouses in the locality of Geneva.

In the investigations, while dusts of 50-mesh grade or coarser exhibited practically no adhesiveness and possessed little insecticidal value, the finer grades of tobacco dust, containing 1 per cent nicotin, were highly toxic to this aphid. "Hydrated lime mixed with tobacco dust for immediate application had no apparent chemical effect, but produced a distinct change in the physical properties of the material. With tobacco dusts of coarser texture than the lime, such as those of 50-, 100-, or 150-mesh, the physical condition was improved by the addition of hydrated lime. In the case of tobacco dust as fine as the lime itself, the addition of lime reduced its killing power, and such a preparation was, as a rule, weaker and less effective than pure tobacco dust of equal fineness."

The effectiveness of tobacco dust with varying percentages of nicotin and the size of particles has been summarized in the following table:

Toxicity of tobacco dusts to aphis.

Material.	Nicotin content.	Size of particles.	Average killed.
	Per cent.	*Mesh.*	*Per cent.*
Tobacco dust	1.22	100	67.6
Do	1.25	150	82.8
Do	1.45	200	95.8
Complete sample	1.44	[1] 200	95.7
Reground tobacco dust	1.12	100	74.7
Do	1.31	150	89.0
Do	1.41	200	96.8
Complete sample	1.45	[2] 200	94.2

[1] 82 per cent. [2] 83 per cent.

"In this series of experiments the most desirable grades of tobacco dust were slightly less active than dusting preparations containing nicotin sulphate or free nicotin in combination with such carriers as lime or sulphur, but evinced greater killing power than those nicotin mixtures composed of kaolin. Exposure to the fumes of the different dusts resulted in the destruction of as large a percentage of the aphids as was produced by the direct contact of the different preparations with the bodies of the insects."

Action of soap upon lead arsenates, R. M. PINCKNEY (*Jour. Agr. Research [U. S.], 24 (1923), No. 1, pp. 87–95*).—In view of the reported damage to leaf crops caused by the addition of soap to the water used for applying lead arsenate as an insecticide, a study was made at the Montana Experiment Station of the solubility of lead arsenates in soaps prepared in the laboratory from palmitic and oleic acids. The lead arsenates used were two samples furnished by manufacturers under the labels Monoplumbic Lead Arsenate and Triplumbic Ortho Lead Arsenate. An analysis of the former showed that only about 67 per cent of the material was diplumbic arsenate ($PbHAsO_4$), the rest of the arsenic being present in some other form. The other sample, on analysis, showed the presence of only 1.7 per cent of $PbHAsO_4$. The two samples furnished, respectively, arsenic equivalent to 31.53 and 25.75 per cent As_2O_5 and lead equivalent to 65.4 and 72.1 PbO. The stearic soap contained 83.1 per cent of moisture and 0.85 per cent of free alkali calculated as sodium carbonate, and the oleic soap 83.5 per cent of moisture and no free alkali. The soaps were both used in two concentrations, 0.6 and 1.8 gm. on the dry basis per 2 liters of solution.

In bringing the materials into contact two methods were used, in one of which the arsenates were ground in water and poured into the soap solution and in the other ground in the soap solution and poured into water. When thus mixed, the bottles were stoppered and shaken at intervals for 5 days and the contents then filtered through paper with suction. The filtrate, after the removal of dissolved soap by barium chlorid, was analyzed for arsenate and the insoluble material for lead and total arsenic.

No constant difference could be noted in the amount of arsenic dissolved as the result of the two methods of mixing. The data obtained indicated, however, that both soaps dissolved arsenic from both samples of lead arsenate and, therefore, may cause damage to foliage, but that the arsenic from the diplumbic salt is more readily dissolved than the more basic compound and that sodium stearate is much more effective as a solvent than is sodium oleate.

Important insects affecting garden crops (*New Mexico Sta. Rpt. 1922, pp. 14–20*).—Studies made of the Mexican bean beetle (*Epilachna corrupta* Muls.) here reported upon relate particularly to its migration and hibernation. This beetle was found to occur only along chains of mountains in New Mexico, due probably to its habit of hibernating at high altitudes. In investigations made on trips to the mountains, the beetle was found hibernating 3 miles from the nearest land which had been in beans the preceding year. In a search for other food plants, it was found that the beetles would eat alfalfa after first emerging from hibernation, but a careful search revealed only one other food plant, namely, a species of Chenopodium. In experiments conducted with the view to determining whether the adults possess the power of digging themselves out of hibernation, none of those buried more than 0.5 in. deep in the sandy soil of the valley ever succeeded in extricating themselves. Work of control by mechanical means with a view to taking advantage of the habit of the beetle of dropping to the ground when disturbed is briefly reported upon. It is thought probable that a shock sufficient to jar the larvae off the

plant, even two or three times in the heat of the day, will greatly reduce the number reaching maturity.

Brief mention is made of work with the cabbage aphid, cutworms, and the Colorado potato beetle.

[Two important insect enemies of the strawberry in Arkansas], W. J. BAERG (*Arkansas Sta. Bul. 185 (1923), pp. 3–33, pls. 3, figs. 3*).—This bulletin consists of two papers:

I. *The strawberry weevil, Anthonomous signatus Say* (pp. 3–30).—This is a summary of the present status of knowledge of *A. signatus* based upon a review of the literature and investigations conducted by the author, many of the details relating to which are presented in tabular form. The strawberry weevil is said to be the most important insect enemy of the strawberry in Arkansas, the injury caused by it often reaching from 50 to 100 per cent of the crop. The author finds from 20 to 30 eggs to be deposited by a single female. Their incubation period is from 5 to 12 days with an average of 7 to 8 days. Maturity is reached by the larvae in from 20 to 29 days, the average being 27 days. Pupation is completed in 7 or more days, with an average of 10 days.

Particular attention was given by the author to control measures. He finds that, under the conditions obtaining in the field during the course of the work, the Aroma and Norwood varieties of strawberry are not appreciably injured by the pest, while Klondike and other varieties blooming at the same time are often very severely affected. "Injury by the weevil may, with a fair degree of success, be prevented by dusting the plants with a mixture of lead arsenate and hydrated lime 1 : 4, applied at the rate of about 12 to 15 lbs. to the acre. Two applications should be made, one as soon as about three-fourths of the buds have separated and weevil injury is apparent and the second application about 5 to 7 days later. It is well to dust in the morning when the day promises to be fair. The weevils feed during the day, and much of the desired results of the dusting is accomplished even if a rain falls during the following night. If the dust is applied late in the afternoon and washed off in the following night, the application should be repeated immediately. A mixture of calcium arsenate and hydrated lime 1 : 4 or a mixture of lead arsenate and sulphur 1 : 5 (or 15 : 85) may be used. A hand blower gun is recommended for applying the dust mixture. A wire muzzle covered over with screen wire, 16 meshes to the inch, and equipped with a heavy wire handle, may be used with fairly good results."

A 4-page bibliography is included.

II. *A false wireworm on strawberry, Eleodes tricostata Say* (pp. 31–33).—This is a brief account of the slender, brown grub of the false wireworm, which caused serious injury to newly planted strawberry beds near De Queen in the early spring of 1920. The pest is said to occur commonly in Kansas and Nebraska as a pest on grains and grasses, but has not hitherto been reported as attacking the strawberry. The larvae feed to a slight extent on the crown of the young plant, but most of the injury is done on the roots just below the crown, as a result of which the plants soon wilt and die in a short time. Notes on its life history, based on observations by McColloch in Kansas (E. S. R., 39, p. 363), are presented.

Control measures consist largely in prevention, which it is thought will be similar to those used against white grubs, namely, to avoid setting plants in a rotation following sod. With garden crops, where it feeds in a manner similar to that of cutworm, poisoned bran mash appears to be effective. It has been reported by McColloch that, while poisoned bran readily kills the adult beetles, the larvae suffer no ill effects from it. A list is given of 15 references to the literature.

Bramble fruit insects, A. L. LOVETT (*Oregon Sta. Circ. 45 (1923), pp. 1–9, figs. 2*).—This is a brief popular summary of information on the more important insect enemies of bramble fruits, including the raspberry root-borer, the cane maggot (*Phorbia rubivora* Coq.), tree crickets, the raspberry sawfly, leafhoppers, and several other insects of minor importance.

Currant and gooseberry insects, A. L. LOVETT (*Oregon Sta. Circ. 42 (1923), pp. 3–8, fig. 1*).—This is a popular account, in which the more important insect enemies of the currant and gooseberry in Oregon are dealt with, including the currant fruit-fly, defoliating worms, the currant aphid, root and cane borers, the currant borer, flat-headed borers (*Chrysobothris mali* Horn and *Dicerca pecterosa* Lec.), the black gooseberry borer (*Xylocrius cribratus* Lax.), and minor insect pests.

[A cacao thrips in Porto Rico], J. P. GRIFFITH (*Porto Rico Dept. Agr. and Labor Sta. Ann. Rpt., 1922, p. 34; also in Spanish ed., pp. 35, 36*).—During the winter the red-banded thrips was found attacking the leaves of young mango trees, and the injury became so serious that some of the trees dropped most of the younger foliage. The thrips were effectively destroyed by the application of nicotin sulphate and soap solution.

An outbreak of hopperburn in Vermont, B. F. LUTMAN (*Phytopathology, 13 (1923), No. 5, pp. 237–241, fig. 1*).—A report of studies made during the summer of 1921, when many plants in fields were almost denuded of their foliage by tipburn in a few weeks, and in 1922, when the bulk of the injury was of insect origin.

The cabbage aphid and its extermination, N. N. BOGDANOV-KAT'KOV (*Kapustnaia Tlia i Mery Bor'by s Nei. Moscow: Vseross. Soiuz Selsk. Khoz. Koop., 1922, pp. 20, pl. 1, figs. 14*).—This is an account of *Aphis brassicae* L., which is one of the most important insect enemies of cabbage in Russia.

The natural control of the fall webworm (Hyphantria cunea Dru.), together with an account of its several parasites, J. D. TOTHILL (*Canada Dept. Agr. Bul. 3, n. ser. (1922), pp. 107, pls. 6, figs. 99*).—The author first considers the natural control of the webworm, based upon studies in different sections of Canada, namely, at Fredericton from 1912 to 1918, in New Brunswick as a whole from 1912 to 1918, in Nova Scotia from 1916 to 1918, and in southern British Columbia from 1917 to 1919. This is followed by reports of studies of the life history, bionomics, etc., of the individual parasities, namely, the tachinids *Compsilura concinnata* Meig. (pp 36–43), *Lydella hyphantriae* n. sp. (pp. 43–48), and *Ernestia ampelus* Wlk. (pp. 49–59), and the hymenopterous parasites *Campoplex* (*Ameloctonus*) *pilosulus* Prov. (pp. 59–74), *C.* (*Ameloctonus*) *validus* Cress. (pp. 74–76), *Apanteles hyphantriae* Ril. (pp. 76–88), and *Therion morio* Fab. (*Exochilum mundum* Say) (pp. 88–102). Then follow some general remarks on the parasites, including interparasitic warfare, the sequence of parasites, and secondary parasitism, with a discussion of some defensive measures of Hyphantria against its enemies, including the armature of the larva, the community web as a weapon of defense, phagocytosis, and the habit of flying away from parasites.

Controlling peach tree borers with paradichlorobenzene, O. C. MCBRIDE (*Missouri Sta. Circ. 112 (1923), pp. 4, figs. 2*).—This is a brief summary of information on the use of paradichlorobenzene against peach tree borers, which the author states is the only known chemical that will control from 92 to 100 per cent of the pest.

On the occurrence of the oriental peach moth (Laspeyresia molesta Busck) in France, B. TROUVELOT (*Bul. Soc. Ent. France, No. 15 (1922), pp. 220–223*).—This pest was first observed at Fréjus, in the south of France, in

the summer of 1922, but it is thought to have been present there since 1919. The rapidity with which it increased in the environs of Fréjus and the difficulty of control are said to make it a serious menace to fruit production in the south and perhaps in the whole of France. Attention is called to the record of its occurrence in Italy by Paoli in 1921 (E. S. R., 47, p. 760).

Platyedra gossypiella Saund., the pink bollworm, in South India, 1920–1921, E. BALLARD (*India Dept. Agr. Mem., Ent. Ser., 7 (1923), No. 10, pp. 171–193, pls. 3*).—Studies here reported, the details of which are presented largely in tabular form, have been summarized as follows:

"Figures obtained this year seem to indicate that the actual loss sustained by a cotton crop from Platyedra during the season picking is one-third of the boll infestation and during the kar picking one-half. Earias is a much less important pest, although one larva does more damage than one Platyedra larva. Loss due to Earias may be roughly estimated at one-half the boll infestation. Examination of entire crop from a field of about 4 acres showed the loss due to pink bollworm to be 11 per cent and *Earias* spp. 3 per cent. The enforcement of the Pest Act has been attended by good results and should be continued. Figures are given showing how much bud and young boll shedding is due to Earias and Platyedra. Figures are also given which show that one Platyedra larva needs one to three seeds to complete its development. The 'long-cycle' Platyedra larvae do not occur in South India. The increase in green boll infestation on Central Farm and in various districts is shown in the tables."

An account of experiments on the control of Siga (Schoenobius) incertellus in the Godavari Delta, E. BALLARD (*India Dept. Agr. Mem., Ent. Ser., 7 (1923), No. 13, pp. 257–278, figs. 5*).—This is a report of studies of the rice or paddy stem borer, the most injurious of all rice pests in India. The studies reported upon have led to the following conclusions:

"The method of selecting attacked seedlings at the time of transplanting gives some hope of constituting an effectual control of Schoenobius. Close cutting used in combination with seedling selection should also destroy a large proportion of the larvae from which the succeeding crop could be infected. Burning stubble was not found to be practicable, but should be tried again. Figures are given showing (1) infestation in plats selected for estimation of attack in the whole area for different seasons, (2) number of broods of Schoenobius in the year, and (3) proportion of spent to gravid moths caught. It is very doubtful whether light traps would be of much use as a control for Schoenobius. Results of a few experiments with colored lights were negative."

The apple and thorn skeletonizer, B. A. PORTER and P. GARMAN (*Connecticut State Sta. Bul. 246 (1923), pp. 245–264, pls. 4, figs. 3*).—This is a combined report of investigations conducted independently by an agent of the U. S. D. A. Bureau of Entomology and an agent of the station. Since the discovery of the pest in the lower Hudson River Valley in 1917 by Felt (E. S. R., 38, p. 60) and in southwestern Connecticut in 1920 (E. S. R., 49, p. 356), it has spread up the Hudson Valley to Albany, over nearly the entire State of Connecticut, and into western Massachusetts. Many neglected orchards, small home orchards, and roadside trees have been nearly defoliated by this pest in many parts of Connecticut.

The authors' investigations which were conducted in Connecticut during the season of 1922, show that the insect passed through three generations, the larvae of the first generation being present on the trees during May and early June, those of the second from late June to early August, and those of the third from August to the middle of October. "A very fractional fourth generation started during an unusually warm period in October, but a freeze ruined the

food supply before any of the larvae had passed beyond the early instars. Hibernation in the winter of 1922–23 will occur almost entirely in the adult stage; under certain conditions some individuals may hibernate in the pupal stage.

"A number of different parasites have been reared from the larvae and pupae of the skeletonizer, for the most part in small numbers. It is to be hoped that these and other natural enemies will increase in numbers and effectiveness and will in the near future bring this new pest within more reasonable bounds. The usual spray schedule will ordinarily keep the skeletonizer under control. The third generation will probaly cause the most trouble in commercial orchards. In case this brood threatens serious damage, it can be easily controlled by an additional application of arsenate of lead at the rate of 1 lb. of the dry form in 50 gal. of water, put on when the larvae are becoming numerous, the middle to the latter part of August."

A bibliography of 15 titles is included.

Further experiments in the control of the cabbage maggot (Chortophila brassicae Bouche) in 1921, W. H. Brittain (*Acadian Ent. Soc. Proc., No. 7 (1921), pp. 49–71*).—This is a report upon experiments carried out in continuation of those during 1919 and 1920, previously noted (E. S. R., 46, p. 248).

Corrosive sublimate at strengths of 1–1,000 and 1–1,500 and several other substances including Derris 3 lbs. to 100 gals., crude creosote 1 per cent with clay 99 per cent, anthracene oil 1 per cent with clay 99 per cent, corrosive sublimate 1 per cent with tobacco dust 99 per cent, and pyridin 5 per cent with clay 95 per cent, were employed. The two treatments that have shown superiority over all others, namely, corrosive sublimate and creosote, were tested in a commercial market garden near Truro, N. S., 3,000 plants, divided into 30 rows and set 2 ft. apart each way, being used. The results of the work, which are reported in tabular form, show a considerable variation from those of the previous year due to the extremely abnormal weather conditions that prevailed during the summer. A number of materials appeared to be superior both in cost and convenience of application to the old tar paper disk treatment. The corrosive sublimate, used in solution and thus more conveniently applied, and being a material readily available, is considered to have marked advantages over the other treatments. The fact that it is not merely repellent in its action but will destroy maggots several days old, allowing a much wider latitude as regards times of application than a purely repellent mixture, is considered the big feature in its favor. It is found that under average conditions 1 gal. of the liquid will cover 20 plants.

In a test made of the effect of corrosive sublimate on seedling plants, it was found that until plants were four days old all the strengths used burned the leaves, but after the fourth day no injury was apparent. In control work with cabbage seedlings, corrosive sublimate applied at the rate of 1 to 1,000, on May 30, 13 days after the fly appeared and 19 days after the plant penetrated the soil, reduced the infestation to 10 per cent as compared with 57.8 per cent on the check plat. In control work with radish, infestation was reduced to nil by use of corrosive sublimate. Dust treatments are not adapted to low leafy plants like the radish. On white turnips creosote dust and corrosive sublimate 1–1,000 were tested, applications being made on May 21 and June 6. Both the materials proved of little value, as the treated plats gave nearly as high infestation as the check plat, due to the long growing season. Tests showed that corrosive sublimate 1–1,000 destroyed all eggs and larvae up to 3 days old. At 7 days from 90 to 100 per cent were killed or disappeared, at 9 from 80 to 85 per cent, at 14 a big variation occurred, and from this time the results can not be considered satisfactory or dependable.

A list is given of 13 cruciferous plants susceptible to cabbage-root maggot attack. Studies of the susceptibility of varieties show that the Large Red Drumhead cabbage is the only one totally immune from attack, while three other varieties of cabbage showed an infestation of 50 per cent or less. All the varieties of cauliflower suffered severely, but the two varieties of Brussel sprouts showed a considerable difference in susceptibility, or at least in degree of resistance to attack.

The cabbage maggot, L. CAESAR (*Ontario Dept. Agr. Bul. 289 (1922), pp. 39, figs. 15*).—This summary of information on the cabbage maggot includes the results of studies of the life history and habits of the pest and means for its control in Ontario.

The author finds that, of 11 methods tested, the best means of control consists in treating the soil immediately around the roots of the plants with corrosive sublimate dissolved in water at the strength of 1 oz. to 10 gal. of water for cabbage and cauliflower plants, and 1 oz. to 8 or 10 gal. of water for radishes and seed beds of late cabbage and cauliflower, or occasionally also of early cabbage and cauliflower. It is pointed out that, while a single treatment will sometimes suffice, it is nearly always wise to give two, and some growers prefer three for cabbage and cauliflower.

The work has shown that the corrosive sublimate solution protects the plants by destroying many of the eggs and also by preventing the maggots from feeding upon the plants. While late applications may at times do some good, it is the early applications that save the crop and allow the plants to develop normally. It appears that for the best results the corrosive sublimate solution should be applied for early cabbage and cauliflower on the third or fourth day after setting out, and for radishes and seed beds on the third or fourth day after the plants have come through the soil, provided oviposition has commenced. The second application in the case of transplanted cabbage and cauliflower should be made one week after the first, and in the case of radishes and seed beds of cabbage and cauliflower five or at most six days after the first. Much of the data is presented in tabular form.

Dusting for the cotton boll weevil, B. R. COAD and T. P. CASSIDY (*U. S. Dept. Agr., Dept. Circ. 274 (1923), pp. 3*).—This circular points out the conditions under which it will pay to dust for the control of the boll weevil, and describes the dusting machines which should be used and the manner in which the dust should be applied.

Suggestions relative to the boll weevil, C. E. SANBORN (*Oklahoma Sta. Circ. 53 [1923], pp. 3–16, figs. 11*).—This is a brief summary of information on the boll weevil and measures for preventing its injury.

Distribution of Arizona wild cotton (Thurberia thespesioides), H. C. HANSON (*Arizona Sta. Tech. Bul. 3 (1923), pp. 49–59, figs. 3*).—In this bulletin the author reviews and tabulates the literature relating to the distribution of the host plant of the wild-cotton boll weevil (*Anthonomus grandis thurberiae*) in Arizona. A map is given of the southern part of Arizona showing the known distribution of the Arizona wild cotton and the wild-cotton boll weevil. It is concluded that intensive scouting in the future will undoubtedly show a wider distribution of Thurberia. The bibliography consists of 15 references.

A graphic representation of the oviposition of a queen bee, I, II, C. BRUNNICH (*Bee World, 4 (1923), Nos. 11, pp. 208–210, figs. 2; 12, pp. 223, 224*).—Observations by the author are tabulated and charted.

The wheat strawworm and its control, W. J. PHILLIPS and F. W. POOS (*U. S. Dept. Agr., Farmers' Bul. 1323 (1923), pp. II+10, figs. 12*).—This is a practical summary of information on *Harmolita grandis* Ril. and means for its control. Studies of this pest have been previously noted (E. S. R., 42, p. 752).

Some braconids parasitic on aphids and their life history, E. W. WHEELER (*Ann. Ent. Soc. Amer., 16 (1923), No. 1, pp. 1–29, figs. 9*).—In this paper the author defines the various larval types of parasitic Hymenoptera, and reviews previous papers on the larval stages of the Chalcidoidea, Proctotrypoidea, and Ichneumonoidea. The life histories of Aphidiinae (Braconidae) are discussed with special reference to the larval stages of *Aphidius ribis* Hal., *A. phorodontis* Ash., *Lysiphlebus testaceipes* Cress., *Praon simulans* Prov., *Ephedrus incompletus* Prov., and *Diaeretus rapae* Curtis. The paper includes a bibliography of 56 titles.

FOODS—HUMAN NUTRITION.

Fundamentals of biochemistry in relation to human physiology, T. R. PARSONS (*Cambridge, Eng.: W. Heffer & Sons, Ltd., 1923, pp. X+281, pl. 1, figs. 22*).—This is an elementary textbook on the theoretical principles which have been derived from the study of the chemical changes occurring in the human body.

Chemistry of foods, condiments, and other commodities.—II, Foods, condiments, and other commodities, their preparation, properties, and composition, J. KÖNIG (*Chemie der Nahrungs- und Genussmittel sowie der Gebrauchsgegenstände. II, Die Nahrungsmittel, Genussmittel und Gebrauchsgegenstände, ihre Gewinnung, Beschaffenheit und Zusammensetzung. Berlin: Julius Springer, 1920, 5. ed., rev., vol. 2, pp. XXV+932*).—This is a revision of the volume previously noted (E. S. R., 15, p. 991).

Food control during 46 centuries, M. G. LACY (*Sci. Mo., 16 (1923), No. 6, pp. 623–637*).—A summary is given from the literature available relating to food control in Egypt from 2830 B. C., China 424–387, B. C., Athens 404–337 B. C., Rome 301–361 A. D., Great Britain 1199–1815, Dutch Republic 1584–85, India 1770 and 1866, colonial United States 1633–1779, and France 1789–1793.

The medical examination of food handlers, C. V. CRASTER (*Amer. Jour. Pub. Health, 13 (1923), No. 3, pp. 196–201, figs. 3*).—A brief report is given of the results of the medical examination of all food handlers in Newark, N. J., for the years 1920, 1921, and 1922. Among the 11,851 examinations made during this period, there were 1,459 cases suspicious of tuberculosis, 91 of positive tuberculosis, 37 of venereal disease, and 54 of skin disease. Of the entire number 218 were required to be vaccinated. No typhoid or diphtheria carriers were found.

The preservation of food by freezing, with special reference to fish and meat: A study in general physiology, W. STILES ([*Gt. Brit.*] *Dept. Sci. and Indus. Research, Food Invest. Bd., Spec. Rpt. 7 (1922), pp. 186, figs. 20*).—This report deals with the problems involved in the preservation of food substances in the frozen condition. Following a brief introduction, three chapters are devoted to theoretical discussions of the physical and chemical principles involved in the freezing process, a comparison of the efficacy of different freezing methods from the standpoint of the rapidity of the freezing process and the interaction between the freezing medium and the frozen material, and the general principles underlying the preservation of food during the period of storage. The principles discussed in these three chapters are then applied to the practical problems of the preservation of fish and of meat by freezing. Throughout the report the advantages are emphasized of freezing over chilling as a means of preservation in cold storage of such materials as meat, fish, and poultry, and of the possibility of extending this process to other materials.

The digestibility of fats, C. F. LANGWORTHY (*Indus. and Engin. Chem., 15 (1923), No. 3, pp. 276–278*).—This is a summary of the extensive investigations on the digestibility of fats conducted by the Office of Home Economics, U. S. D. A. The detailed reports of these studies have been previously noted from other sources (E. S. R., 47, p. 559). Tables combining the data reported in these various papers are given for the coefficients of digestibility of animal fats, of vegetable fats, and of hydrogenated oils.

The reciprocal transformation of creatin and creatinin.—IV, The origin of creatinin in the organism, A. HAHN and G. MEYER (*Ztschr. Biol., 78 (1923), No. 1–2, pp. 91–118*).—Using the methods outlined in the preceding paper of this series (E. S. R., 48, p. 808), the authors have attempted to trace the origin of creatinin in the body.

Blood, blood serum, and the extracts of various organs (beef liver and kidney, hog liver, and dog liver) were subjected to autolysis with determinations of creatin and creatinin before and after the autolysis. No evidence was obtained of any enzym capable of decomposing the creatin or creatinin or transforming creatin into creatinin. Similarly no enzym of such a nature was found in human urine. The feeding or a single subcutaneous injection of a large amount of creatin was followed by no significant increase in the amount of creatinin.

It is concluded that creatinin owes its origin to a reaction in the muscle. To keep the creatin content of the muscle constant, a certain percentage of creatin is converted into creatinin, and the greater permeability of the kidney epithelium to creatinin leads to its elimination.

Variations in some of the urinary constituents and the alveolar carbon dioxid tension in relation to meals, E. C. DODDS (*Brit. Jour. Expt. Path., 4 (1923), No. 1, pp. 13–19*).—The study reported forms a part of a series of investigations into the means adopted by the body to keep the reaction of the blood constant during meals, the particular point under investigation in the present instance being the composition of the urine with respect to ammonia and titratable acidity before and after breakfast and lunch.

It was found that the first meal of the day was followed by a decrease in the excretion of acid and ammonia, calculated per hour. This so-called alkaline tide lasted for one or two hours, and was followed by a period of increased excretion of acid and ammonia or an acid tide lasting for about two hours. If a second meal was taken during this period there was no or only slight evidence of an alkaline tide such as followed the breakfast. That this was due to the counteracting effect of the late acid tide was shown by a repetition of the experiment with the subject fasting until the time for the second meal. Under these conditions the same alkaline effect was noted.

These results are thought to indicate that the alkaline tide is associated with gastric secretion and the acid tide with pancreatic secretion.

Respiratory metabolism, blood reaction, and blood phosphoric acid during mental work, H. W. KNIPPING (*Ztschr. Biol., 77 (1922), No. 1–3, pp. 165–174*).—Using a Benedict respiration calorimeter, the oxygen consumption and the carbon dioxid output were determined for short periods on a number of subjects of different ages doing mental work of various kinds.

The tabulated results of these experiments show a small but significant caloric expenditure for mental work. Calculated as calories per hour, the highest figure obtained was 16.3 calories per hour for rapid multiplication tests. Other values were 3.6 calories for easy arithmetic problems, 12.8 in the case of a child for a geography test, and 7.8 for an older student studying a difficult biology textbook. It is concluded that the caloric expenditure for mental work compared with that for manual work is so small as to be

negligible, but is sufficient to distinguish between different kinds of mental work and the same work performed by different people.

In all of the tests reported, there was an increase in the respiratory quotient at the beginning of the period of mental work, followed by a decrease during the work. The explanation offered for this is that during mental work phosphoric acid enters the blood from the central nervous system and tends to drive out the carbon dioxid, thus lowering the CO_2 capacity of the blood. Determinations of the phosphoric acid content of the blood of 5 subjects at rest and during mental work gave widely varying results, but in all cases higher figures during work than at rest.

In applying these results to problems of nutrition, the author cautions against the consumption by mental workers of food of too high caloric value, and emphasizes the value of meat in that it stimulates the digestive juices without furnishing too many calories.

Nutrition during mental work, O. KESTNER and H. W. KNIPPING (*Klin. Wchnschr., 1 (1922), No. 27, pp. 1353, 1354*).—Essentially noted above.

The function of the adrenal glands and its relation to concentration of hydrogen ions, R. MCCARRISON (*Brit. Med. Jour., No. 3238 (1923), pp. 101, 102, figs. 6*).—This is an abstract of the detailed report of an investigation of the cause of hypertrophy of the adrenals, with increased output of adrenalin, in pigeons on diets deficient in vitamins A and B. On the theory that this change might be connected with the increased H-ion concentration of certain organs and muscles observed in polyneuritis, experiments were undertaken to determine the effect of changes in the H-ion concentration of various media on the action of commercial adrenalin hydrochlorid, and of pure epinephrin, on the enucleated eyes of toads.

The results of these experiments showed that there is a distinct relationship between the action of these substances and the H-ion concentration of the medium, an increase in H-ion concentration necessitating an increased quantity of adrenalin. The author concludes that "the enlargement—with increased epinephrin content—of the adrenal glands in inanition and in avitaminosis may be correlated with the condition of acidosis associated with these states. Its occurrence, for the most part during the terminal phases of avitaminosis, its association with marked respiratory disturbances, with oxygen want, with falling body temperature, and with interference with oxygenation, and its rapid disappearance on the provision of the missing vitamins, suggest that it is an emergency effort on the part of the adrenal glands."

Factors controlling intestinal bacteria.—The influence of H-ion concentration on bacterial types, P. R. CANNON and B. W. MCNEASE (*Jour. Infect. Diseases, 32 (1923), No. 3, pp. 175–180*).—Determinations are reported on the H-ion concentration and the bacterial flora of the cecum and the colon of white rats fed nothing but uncooked ground beef and of others fed the same meat with which lactose had been mixed in the proportion of 1 part of lactose to 3 of meat.

On the former diet the feces were foul smelling and the bacterial flora was of a gas-producing proteolytic type, while on the latter *Bacillus acidophilus* predominated. On the meat diet the H-ion concentration of the contents of both the cecum and colon varied from pH 7 to 7.1, and on the meat-lactose diet the H-ion concentration of the cecum was about 4.6 and of the lower colon 6.2. These results are thought to indicate that determinations of the actual acidity of the feces are of slight value in interpreting the reaction of the intestinal contents higher up, and also to indicate a relationship between intestinal flora and H-ion concentration, increasing acidity being characterized by the replacement of proteolytic types by aciduric types, chiefly *B. acidophilus*.

The influence of vitamin A on the blood platelets of the rat, S. P. Bedson and S. S. Zilva (*Brit. Jour. Expt. Path., 4 (1923), No. 1, pp. 5–12, figs. 3*).—The authors have repeated the work of Cramer et al. (E. S. R., 49, p. 61) on the blood platelet counts in rats on diets deficient in vitamin A and report a much less marked diminution in the number of blood platelets. Although young growing rats fed a diet deficient in vitamin A showed a lower platelet count than that of normal rats at the same age, the greatest reduction was only 21.3 per cent. This is thought insufficient to warrant the conclusion that a lowering of the blood platelets is a specific lesion of vitamin A deficiency.

Studies on qualitative undernutrition.—II, The experimental detection of antineuritin, F. Hofmeister (*Biochem. Ztschr., 129 (1922), No. 5–6, pp. 477–486, figs. 7*).—For the detection of vitamin B, the author recommends rat feeding tests in which the animals are kept on a diet deficient in vitamin B until they have been losing in weight for a considerable period of time. A single dose of the substance to be tested is then given, and its effect upon the weight curve is noted. A temporary increase in weight, followed by a decrease, is considered proof of the presence of vitamin B in the substance tested, and the time elapsing before the weight has again dropped to the same figure as when the first dose of vitamin was given is considered an indication of the strength of the preparation in vitamin B. The vitamin dosage can be repeated once or twice in like manner with a similar response in gain in weight, but after the animal has developed atactic or paralytic symptoms there is no longer a response to the addition of the vitamin.

The first paper of this series has been noted previously (E. S. R., 47, p. 769.)

Vitamin B and the sexual glands, H. Gotta (*Compt. Rend. Soc. Biol. [Paris], 88 (1923), No. 5, pp. 373–375*).—In this study of the effect of absence of vitamin B on the sexual glands, 31 pigeons averaging 300 gm. in weight were placed in separate cages and submitted to various diets as follows: One lot of 11 received the basal diet lacking in vitamin B described by Simonnet (E. S. R., 45, p. 166). A second lot of 7 received the same diet, with the addition of 2.5 gm. of fresh brewery yeast daily. Both of these lots were fed forcibly in daily amounts equal to one-fifth of their body weight. A third lot of 13 was fed corn ad libitum. The pigeons were killed when those in the first group showed marked signs of polyneuritis, and on autopsy the testicles or ovaries, liver, heart, and kidneys were weighed.

In the males the testicles of the pigeons in the order given above weighed 117, 566, and 1,313 mg., respectively. In the females on the first and third diets the weights of the ovaries were 129 and 373 mg., respectively. It is considered of significance not only that the weight of the testicles should be much less in the pigeons on the deficient diet than in those on the deficient diet supplemented by yeast, but that the latter should be so very much smaller than those on the corn. In explanation of this, it is suggested that the yeast furnished a sufficient quantity of vitamin B to prevent the general symptoms of polyneuritis but not sexual atrophy, or that still another unknown factor was lacking in this diet, or finally, that the meat residue exerted a harmful action on the testicle.

Studies on yeast.—V, The vitamin B content of yeast, V. G. Heller (*Jour. Biol. Chem., 55 (1923), No. 3, pp. 385–398, figs. 8*).—The relative vitamin B content of bakers' yeast grown on wort and on the synthetic medium F, described by Fulmer et al. in a previous paper of the series (E. S. R., 45, p. 565), was determined by feeding experiments with young rats on a basal diet of purified casein 18, salt mixture 5 or 3.7, filtered butterfat 5, and dextrin to make up 100 parts, with air-dried yeast (*Saccharomyces cerevisiae*) as the sole source of vitamin B.

Of the yeast grown on wort, 2.5 per cent proved sufficient for growth at normal rate and for reproduction. The young, however, appeared to be in poor nutritive condition and seldom grew to maturity. Of a litter of 4, the offspring of a female which had grown to maturity at normal rate on this diet, only 1 lived more than 4 weeks and its growth was not normal. With 5 per cent of yeast growth was normal, and normal young were produced which were in somewhat better condition than the offspring of the rats on 2.5 per cent yeast. With the same yeast used in the fresh state, rapid growth resulted on 6 per cent of the yeast corresponding to 2.04 per cent of the dried substance, thus showing that drying brings about a slight reduction in the vitamin B content of the yeast. The animals on this diet reproduced, but the young, although normal in size at birth, did not develop normally and died before weaning.

The yeast grown on a synthetic medium produced only slow growth when fed at a 2.5 per cent level. When 3 per cent of the yeast was used, growth was better but not equal to that on 2 per cent of yeast grown on wort. With 4 per cent of this yeast normal growth was secured over a period of 2 months, beyond which the experiment was not continued.

A few experiments are also reported in which the antineuritic property of yeast grown on the synthetic medium was tested by feeding the yeast to pigeons in the acute stage of polyneuritis. Cures were effected with 3 gm. of the moist yeast containing about 1 per cent of air-dried solids.

The antiscorbutic vitamin in some oriental fruits and vegetables, H. EMBREY (*Philippine Jour. Sci., 22 (1923), No. 1, pp. 77–82, pls. 5*).—A brief report is given of a study of the antiscorbutic properties of various oriental fruits and vegetables tested at the Bureau of Science in Manila, and of Chinese persimmons tested at the Union Medical College in Peking, China. Four guinea pigs were used in testing each of the materials, which in general were fed in 10 gm. amounts.

The results as shown by growth curves are somewhat difficult to interpret on account of the large number of deaths from intercurrent infection. Of four animals receiving as antiscorbutic 10 gm. daily of the materials under investigation the reported deaths from scurvy are as follows: Papaya, pomelo, chico (*Achras sapota*), and guava none; lansones (*Lansium domesticum*) one; and pepino or cucumber two. Other materials tested, with the amount fed and number of deaths from scurvy, are camote or sweet potato leaves 15 gm. with two deaths, kangkong leaves (*Ipomoea reptans*) 15 gm. with three deaths, dwarf or Chinese banana (*Musa cavendishii*) 15 gm. and no deaths, banana flower bud 10 cc. with four deaths, and coconut juice 10 cc. with four deaths. Of the persimmon 25 gm. daily of the fresh raw fruit proved insufficient and 30 gm. sufficient to protect the animals against scurvy.

The protection of vitamin C in foods, E. F. KOHMAN (*Indus. and Engin. Chem., 15 (1923), No. 3, pp. 273–275*).—This paper consists largely of a discussion of the investigations of La Mer et al. from which the conclusion was drawn that the destruction of vitamin C in tomatoes heated under varying conditions was due to heat and not to atmospheric oxygen (E. S. R., 46, p. 865). Evidence is presented that fruits and vegetables may contain sufficient dissolved oxygen to become an important factor in the destruction of vitamin C on heating. It is suggested that the apparently greater stability with respect to vitamin C of tomatoes than of cabbage on heating, as reported by Delf (E. S. R., 41, p. 167), may be due to the fact that the cooking of cabbage requires considerable water, which always has more or less dissolved oxygen, while tomatoes are canned without the addition of any water.

The author is of the opinion that in all experiments dealing with the stability of vitamin C toward heat account must be taken of the oxygen in the product and in the cooking water as well as of atmospheric oxygen. The oxygen may be removed from the cooking water by boiling for several minutes. "To remove the oxygen from milk, fruit juices, and other liquid foods without the application of heat, a vacuum exhaust with mechanical agitation or a sufficient vacuum to cause ebullition must be applied. To remove the oxygen from solid food products without heat, they may be subjected to a high vacuum under water for considerable time with adequate agitation to overcome supersaturation, or a vacuum may be applied without covering with water and then released with nitrogen. Subsequent exposure to the atmosphere must be avoided. Respiration of fruits and vegetable may also be utilized to deprive them of oxygen."

The significance of various vitamins for iron assimilation in growing individuals, and the composition of the body ash on vitamin-free and vitamin-containing foods, S. YOSHIUE (*Biochem. Ztschr., 134 (1922), No. 1–4, pp. 363–374*).—In this investigation 5 groups of young mice (from 11 to 15 animals in each group) were fed a basal diet of polished rice ad libitum, 0.15 gm. of an iron salt, triferrin, and 0.03 gm. of a salt mixture consisting of calcium lactate 50, magnesium citrate 50, sodium chlorid 125, and potassium chlorid 5 parts. In addition 1 group received daily 3 gm. of butter, or 3 gm. of rice bran, or 3 gm. of cabbage juice, or a mixture of all three. After 4 weeks on these diets the animals were killed and ash determinations made on the total body with the exception of the intestinal tract. The results of these analyses are given in the accompanying table.

Ash constituents in body tissues of mice on various diets.

Supplementary diet.	Weight in 100 gm. body weight.						Weight in 1 gm. ash.					
	Fe.	KCl.	P_2O_5.	CaO.	$Mg_2P_2O_7$.	NaCl.	Fe.	KCl.	P_2O_5.	CaO.	$Mg_2P_2O_7$.	NaCl.
	Mg.	*Mg.*	*Mg.*	*Mg.*	*Mg.*	*Mg.*	*Mg.*	*Mg.*	*Mg.*	*Mg.*	*Mg.*	*Mg.*
Butter (vitamin A)	9.9633	364.4	1,799.5	1,653.3	143.8	484.6	2.71	98.8	488.8	454.1	41.2	131.5
Rice bran (vitamin B)	10.8467	399.8	1,608.1	1,368.3	117.3	507.5	3.19	120.0	472.7	410.7	35.2	152.8
Cabbage juice (vitamin C)	11.4987	386.5	1,752.7	1,529.9	133.5	497.3	3.23	109.8	480.0	431.1	37.5	142.5
No addition	9.1125	345.6	1,929.4	1,735.7	157.2	459.7	2.46	89.9	503.1	459.7	41.5	121.4
Butter, rice bran, and cabbage	11.4625	402.6	1,572.7	1,241.0	95.8	513.6	3.54	125.7	494.5	385.5	29.5	159.5

The highest ash content was in those animals receiving the most deficient diet, and then in decreasing order in those receiving vitamin A, vitamin C, vitamin B, and the normal diet, the last having the lowest ash content calculated on the basis of body weight. The total ash content in percentage of body weight averaged 3.8371 per cent in the animals on the most deficient diet, 3.6798 in those on a diet furnishing vitamin A, 3.6518 on vitamin C, 3.4001 on vitamin B, and 3.2296 per cent on the normal diet. The values for calcium, magnesium, and phosphorus followed the same order, while the reverse order was true for iron, potassium, and sodium, thus indicating that vitamins B and C are more favorable than A for the deposition of these elements. The data are thought to indicate a direct disturbance in the iron metabolism as a result of vitamin deficiency.

Vitamins and iron metabolism in grown individuals, K. HARAMAKI (*Biochem. Ztschr., 134 (1922), No. 1–4, pp. 354–359*).—A full-grown dog weigh-

ing 6,350 gm. was kept for 6 weeks on a vitamin-deficient ration of meat 35, polished rice 25, lard 35, an iron-containing salt mixture 1.5, common salt 0.5, and distilled water 800 gm. This ration furnished 4.7378 gm. N and 0.10656 gm. Fe daily. At the end of this initial period the body weight had fallen to 5,000 gm., and the animal was suffering from ophthalmia. The nitrogen balance was determined in 3-day periods throughout the entire experiment and the iron balance after the first 9 days. The figures for the nitrogen balance in the five successive periods of the preliminary experiment were —0.7324, —0.4425, +1.2932, +0.4526, and —0.7946 gm., respectively. The iron balances for the last two periods were +0.04999 and +0.06974 gm., respectively.

The ration was then changed to polished rice 5, sugar 6.7, fresh orange juice 30, and butter 35 gm., with the same amount of meat, salt mixture, and water as before. This ration furnished 4.73 gm. of nitrogen per day. The nitrogen balances for five consecutive 3-day periods on this ration were —1.0798, +0.6575, —0.2958, +0.0537, and +0.3705 gm., and the corresponding iron balances +0.05887, +0.06105, +0.04124, +0.07175, and +0.06663 gm., respectively. The iron balances in two 7-day periods following were +0.08379 and +0.08106 gm. The average iron balance for the entire vitamin-free period was +0.05975 gm., for the first half of the vitamin-containing period 0.05991 gm., and for the last half of the vitamin-containing period +0.07077 gm.

It is concluded that the bodies of grown animals can retain iron without vitamins, but that the vitamins have a favorable effect upon iron retention when given after a long period on a vitamin-deficient diet.

The blood of rats on a deficient diet, H. Damianovich, A. Bianchi, and L. A. Savazzini (*Compt. Rend. Soc. Biol.* [*Paris*], *88* (*1923*), *No. 5, pp. 377, 378*).—Rats in groups of 6 each were placed on various deficient diets and observations made on the effect of these diets on the blood. During the deficiency in vitamins A and B an increasing anemia was noted, which was more marked when vitamin B than when vitamin A was lacking. The anemia was of the simple nonregenerative type. The diminution in red blood cells corresponded to the loss in weight. The administration of vitamins increased the number of red blood cells whether the weight was affected or not.

Avitaminosis in fishes, W. Laufberger (*Pflüger's Arch. Physiol., 198* (*1923*), *No. 1, pp. 31–36*).—To determine whether fish require vitamins, three groups of 8 fish (*Amyurus vulgaris*) were placed in separate aquariums supplied with fresh water at frequent intervals, but containing no sand nor water plants. A control group of 6 was kept in an aquarium containing the usual sand and plants. This group was fed regularly with fresh beef, and the other three groups received, respectively, a vitamin-free diet consisting of casein, lard, starch, artificial milk, and salt mixture; the same diet with the addition of egg yolk and yeast to furnish vitamins A and B; and beef extracted with alcohol and ether and dried at 100° C. This was thought to contain vitamin B but not vitamin A. The experiment was continued for 4 months, the fish in each group being weighed together at regular intervals.

There were no deaths in the control group, 6 in the vitamin-free, 3 in the vitamin A and B, and 1 in the vitamin B group. Calculated on the basis of average weight of single fish, those on the control diet gained the most in weight, followed by the group on the diet furnishing vitamins A and B, the one containing B, and the one lacking all three vitamins. The fish on this diet barely maintained their weight.

The author concludes that fish need all three of the vitamins, A, B, and C.

Investigations on carbohydrate metabolism in avitaminosis.—I, Blood sugar, J. A. Collazo (*Biochem. Ztschr., 134* (*1922*), *No. 1–4, pp. 194–214*.

figs. 2).—The author reports that in pigeons fed exclusively on sterilized polished rice there is a progressive lowering of the blood sugar content until about the tenth or fourteenth day of such feeding, when the sugar curve begins to rise. If the pigeons live, the blood sugar finally reaches values higher than normal. Some of the pigeons die before this takes place, but in all cases there is a fall in the blood sugar just before death. If vitamin-rich food is given to pigeons in the state of hyperglycemia or if they are given no food, the blood sugar returns to normal. In fowls the blood sugar follows the same curve except that the hyperglycemic state is less marked. In over 100 experiments with pigeons the normal average value for blood sugar was 0.21 per cent, while in the state of hypoglycemia values as low as 0.12 to 0.06 per cent were found and in hyperglycemia as high as 0.3 to 0.58 per cent.

Guinea pigs on a diet of dried oats and water showed marked hypoglycemia, followed as in the case of pigeons and fowls by hyperglycemia. The normal value is given as 0.1 per cent, while in the state of hypoglycemia it drops as low as 0.05 per cent and in hyperglycemia rises to 0.22 per cent. Dogs are said to show the same changes, but no data are presented.

The explanation advanced for these phenomena is that avitaminosis is at first a form of starvation which tends to lower the sugar content of the blood. This leads to a mobilization of the carbohydrate reserves of the liver to bring the sugar content back to normal. Through disturbances in the cellular metabolism the sugar can not be utilized and consequently increases in amount in the circulating blood.

The influence of function on the course of avitaminoses, S. Yoshiue (*Biochem. Ztschr., 134 (1922), No. 1–4, pp. 375–380, fig. 1*).—Two series of experiments are reported. In one 12 young rats were fed for 2 months on a vitamin-free diet of cooked wheat flour, rice, and salt mixture, and at the end of this time half were allowed to remain quietly in their cages and the other half forced to run on a revolving drum for from 1 to 4 hours daily. When one of the animals in this group died, one from the other group was killed, and both were autopsied and sections of the brain and spinal cord examined. In the other experiment one group of young rats was kept on the vitamin-free diet and the other on a normal diet, and half of each group were forced to exercise daily as in the preceding experiment.

The animals on the vitamin-free diet showed degenerative changes in the spinal cord and brain which were much more marked in the working than in the resting animals. No differences were noted in the working or resting animals on the complete diet.

It is concluded that vitamin starvation lays the foundation for the deveolpment of damage to the organism when stress is put upon it.

The experimental conditions of the action of cod liver oil.—Its osteodystrophic power in the presence of a deficient diet, G. Mouriquand and P. Michel (*Compt. Rend. Acad. Sci. [Paris], 176 (1923), No. 5, pp. 338–340*).—Attention is called to the observations noted in the paper previously noted (E. S. R., 49, p. 365), and further experiments along the same line are reported and discussed.

It was found that guinea pigs fed barley, cod liver oil, crude lemon juice, and hay did not develop scurvy, and similarly that scorbutic guinea pigs on the above diet without hay were promptly cured by the addition of hay to the diet. These observations are thought to indicate that in subjects submitted to a deficient but not scorbutic diet, cod liver oil in large doses has an "osteodystrophic, perhaps scorbutic property" which is not manifest in the case of animals on an otherwise complete diet. It is suggested that in administering

cod liver oil to infants care should be taken that the rest of the diet is adequate.

Experiments with Bacillus (Clostridium) botulinus under household conditions, R. B. EDMONSON, C. THOM, and L. T. GILTNER (*Amer. Food Jour., 18 (1923), No. 3, pp. 143–145*).—This contribution from the Bureau of Chemistry, U. S. D. A., consists of the report of a series of experiments in which culture media and various foods were inoculated with known quantities of toxin-free spores of *B. botulinus* and incubated at different temperatures for varying periods of time with a view to determining the possibility of development of *B. botulinus* toxin in foods kept under household conditions. The food materials tested included canned peas, raw and pasteurized milk, cottage cheese, cream cheese, meat balls, mashed potatoes, and bread inoculated at different periods during the mixing process. The general results obtained are summarized as follows:

"In general, the experiments indicate that food held in a reasonably efficient ice box for from one to two days is practically free from development of *B. botulinus*, even if present, and is entirely safe for ordinary recooking. Further, food held to the third or even fourth day, if not showing physical signs of spoilage, such as mold, scum, souring, or odor, involves little actual danger, but in every case calls for thorough recooking. The results equally clearly show the need of some type of effective refrigerator or cooling device in all households."

ANIMAL PRODUCTION.

Scientific papers of the Second International Congress of Eugenics, I, II (*Baltimore: Williams & Wilkins Co., 1923, vols. 1, pp. X+439, pls. 26, figs. 56; 2, pp. IX+472, pls. 21, figs. 32*).—The papers presented at the Second International Congress of Eugenics, held in New York City, September 22–28, 1921, are published in two volumes entitled (1) Eugenics, Genetics, and the Family and (2) Eugenics in Race and State.

The papers of primary agricultural interest include the following: Research in Eugenics, by C. B. Davenport; Genetics and Adaptation, by L. Cuénot; Inheritance of Unicellular Organisms, by H. S. Jennings; Evolution of the Chromosome Complex, by C. E. McClung; Aberrations in Chromosomal Materials, by C. B. Bridges; Variations in the Jimson Weed (*Datura stramonium*), by A. F. Blakeslee; The Attraction between Homologous Chromosomes, by J. Belling; Linkage with Lethal Factors in the Solution of the Oenothera Problem, by G. H. Shull; A New Type of Variability in Plants, by R. R. Gates; The Analysis of Genetic Differences through Haploid Parthenogenesis, by P. W. Whiting; Mutation, by H. J. Muller; Reverse Mutation, by C. Zeleny; Darwinian Evolution by Mutation, by R. A. Fisher; The Frequency of Mutation and the Incidence of Hereditary Traits in Man, by C. H. Danforth; A Simple Explanation of the Hereditary Mechanism, by L. Legrand; Sex Determination in Rotifers, by A. F. Shull; Some Data on Control of Sex in Cladocera, by A. M. Banta and L. A. Brown; Disturbances in Mammalian Development Produced by Radium Emanation, by H. J. Bagg; The Genetic Significance of the Alcoholic Treatment of White Rats, by E. C. MacDowell; The Relation of Heredity to Tuberculosis, by P. A. Lewis; The Inheritance of Cancer in Mice, by L. Loeb; the Inheritance of a Predisposition to Cancer in Man, by C. C. Little; Inheritance of Eye Defects, by L. Howe; New Data on the Genesis of Twins, by R. A. Fisher; Main Results of a Statistical Investigation of "Finger Prints" from 24,518 individuals, by K. Bonnevie; The Genetics of Fecundity in the Domestic Hen, by C. C. Hurst; The Effects of Inbreeding on Guinea Pigs,

by S. Wright; Is Inbreeding Injurious? by H. D. King; Comparative Development of Successive Offspring of the Same Parents, by E. Rabaud; Hybridization and Behavior, by E. M. Vicari; and Population in Relation to Agriculture, by E. M. East.

The essential parts of some of these papers have been noted from other sources.

The second international exhibition of eugenics, H. H. LAUGHLIN (*Baltimore: Williams & Wilkins Co., 1923, pp. 155, pl. 1, figs. 46*).—An account of the exhibits of this congress is given, and pictures of all exhibits which could be suitably reproduced are included.

Experimental studies on the duration of life, V, VI (*Amer. Nat., 56 (1922), No. 646, pp. 385–405, figs. 2*).—Two papers on the duration of life in Drosphila are presented from the Johns Hopkins University in continuation of those previously noted (E. S. R., 48, p. 471).

V. *On the influence of certain environmental factors on duration of life in Drosophila*, R. Pearl and S. L. Parker (pp. 385–398).—Experiments to study the effect of ventilation and the feeding of embryonic juice on the length of life in Drosophila were carried on. In the first experiment the mean length of life in flies of the Old Falmouth stock (wild) was increased from 43.66±0.39 to 47.92±0.4 days by raising 946 flies in bottles covered with one layer of silk bolting cloth having 48 meshes per inch instead of plugging the bottles with cotton as was done in the case of the 931 control flies which were raised. Contradictory results were obtained with quintuple flies, which are short lived due to genetic factors.

In testing the value of feeding to Drosophila embryonic juice from 14-day-old chicks and from Drosophila larvae, it was found that no advantage resulted from such feeding. There were 1,013 flies in the control, 983 in the lot fed chicken juice, and 994 in the lot fed larval pulp.

VI. *A comparison of the laws of mortality in Drosophila and in man*, R. Pearl (pp. 398–405).—The relation between the duration of life in Drosophila and man is described more specifically than in paper No. 1 (E. S. R., 47, p. 864). The comparable ages are taken as the time of minimal death rate, which is 12 years in man and 1 day in Drosophila, and the age at which there is 1 individual left from 1,000 starting at the age of the minimum death rate. This was found to be 98 years for man and 97 days for Drosophila, meaning that 97 days of Drosophila life equals 86 years of man life, or 1 day of Drosophila life equals 0.8866 years of man life. Graphs showing the survivors at different comparative ages are given, and it is evident that in man there are more survivors at all the different ages, though the general trend of the curves is very similar.

Defective diet as a cause of sterility, D. MACOMBER (*Jour. Amer. Med. Assoc., 80 (1923), No. 14, pp. 978–980*).—In continuation of the study previously noted (E. S. R., 46, p. 261), rats from the stocks of W. E. Castle and H. D. King have been classified according to their degree of fertility, it being assumed that individuals vary by degrees ranging from 0 to 100. Other rats receiving deficient diets in one or more ways were also classified in a similar manner, and it is concluded that a much greater percentage of the rats on the deficient diets were in the classes of lower fertility.

Potassium in animal nutrition.—II, Potassium in its relation to the growth of young rats, H. G. MILLER (*Jour. Biol. Chem., 55 (1923), No. 1, pp. 61–78, figs. 30*).—Continuing previous work (E. S. R., 49, p. 464), it was found in experiments with rats that a ration containing less than 0.1 per cent of potassium greatly retarded growth but did not greatly interfere with the actions or appearances of animals, though they evidently craved something. Response to

the addition of potassium to the diet depended upon the growth stage at which it was added. No favorable effect, however, resulted from its addition during the eleventh week. The addition of potassium during the fourth week brought about partial recovery, but this was not permanent, other symptoms developing later such as cessation of growth, edematous condition of the eyes, and respiratory trouble followed by death.

Since no other physiological disturbances except retarded growth were manifested on the low potassium diet, and since other harmful symptoms appeared after the addition of potassium, it was concluded that inadequate potassium during early growth may cause physiological changes which later become apparent. Rations of low sodium content (about 0.07 per cent) did not affect growth. Neither the potassium nor sodium content of the blood were altered by feeding high potassium rations or interchanging the potassium and sodium in the diet.

Influence of the antineuritic vitamin upon the internal organs of Single Comb White Leghorn cockerels, A. J. SOUBA (*Amer. Jour. Physiol., 64 (1923), No. 1, pp. 181–201, figs. 10*).—For studying the effect of vitamin B on the growth of different organs in cockerels at the Minnesota Experiment Station in a manner similar to the experiment previously noted by Dutcher and Wilkins (E. S. R., 46, p. 271), three lots each consisting of 50 Single Comb White Leghorn cockerels 80 days of age and from the same breeding stock were selected. Lot 1 received a normal poultry ration, whereas lots 2 and 3 received synthetic rations consisting of starch 54 parts, casein 20, butter fat 4, lard 7, and salt mixture 5 parts. Ten parts of a yeast product were also given to lot 2. After the experiment had been running 4 weeks, 25 birds from each lot were killed, and weights and measurements were taken of certain of the glands. The remaining birds in lot 3 were killed when they showed symptoms of polyneuritis. At the same time one bird from each of the other pens was killed for comparison. The differences between the size of the glands were similar at both times, but more pronounced in the later comparisons. The following table gives the live weight and weights of the organs of the birds killed after the test had been running 4 weeks:

Average weights of birds and their organs after four weeks of experimental feeding.

Ration.	Average weights.								
	Bird.	Testes.	Heart.	Kidneys.	Spleen.	Pancreas.	Liver.	Thyroid.	Adrenal.
	Gm.	*Gm.*	*Gm.*	*Gm.*	*Gm.*	*Gm.*	*Gm.*	*Gm.*	*Gm.*
Normal poultry	796	2.70	3.52	6.22	1.10	2.18	20.51	0.04	0.11
Normal synthetic	780	2.19	3.23	5.99	1.29	2.15	22.07	.04	.12
Synthetic diet minus vitamin B	630	.42	2.61	5.21	1.12	2.33	17.59	.03	.11

It is pointed out that practically all the organs decreased in size, due to a vitamin B deficiency, except the adrenals, which are much larger in proportion to body weight on the diet lacking the antineuritic vitamin.

The hydrolysis of straw by the Beckmann process.—II, Influence of the amount of lye on the extent of the nutritive material made available, G. FINGERLING, K. SCHMIDT, and A. SCHUSTER (*Landw. Vers. Sta., 100 (1922), No. 1–2, pp. 1–19*).—In continuing the study of the Beckmann process of hydrolyzing straw (E. S. R., 43, p. 267), the effect on the digestibility of using different amounts of caustic soda per 100 kg. of straw was determined in

digestion experiments with wethers. The following table gives a summary of the digestibility of the straw after treatment with different amounts of the caustic soda. In all cases the treatments lasted 12 hours:

Digestibility of straw hydrolyzed with different amounts of caustic soda.

Caustic soda added per 100 kilograms of straw.	Coefficient of digestibility.			Caustic soda added per 100 kilograms of straw.	Coefficient of digestibility.		
	Organic matter.	N-free extract.	Crude fiber.		Organic matter.	N-free extract.	Crude fiber.
Kilogram.	*Per cent.*	*Per cent.*	*Per cent.*	*Kilogram.*	*Per cent.*	*Per cent.*	*Per cent.*
12	71.22	60.45	80.94	4	50.24	43.42	53.93
10	66.20	53.39	74.72	2	46.26	32.88	54.28
8	66.10	53.14	78.24	None	45.68	40.15	58.02
6	61.05	51.03	71.01				

Experimental contribution to the knowledge of the working conditions of draft animals under different dietary conditions, I. ALBERTONI (*Staz. Sper. Agr. Ital., 55 (1922), No. 4–6, pp. 173–262; abs. in Internatl. Inst. Agr. [Rome], Internatl. Rev. Sci. and Pract. Agr., 13 (1922), No. 10, pp. 1250–1254*).—After reviewing the purpose and occurrence of glucose and glycogen in the muscles of animals, the author reports experiments carried on at the Royal College of Veterinary Medicine at Bologna dealing with the amount of glycogen and glucose in the muscles of horses, mules, rabbits, guinea pigs, and white rats after they had received different basal diets consisting of combinations of pasture, hay (*Dactylis glomerata*), alfalfa, oats, beans, corn, rice, barley, Emmenthaler cheese, and lard for periods of from 5 to 50 days.

The contents of glycogen and glucose in the muscles were assumed to determine the working condition of the animals. The rations containing oats and rice in addition to hay and straw were found to produce more glycogen in the muscles of horses than the rations of any of these substances alone. Mules on the same rations did not produce as much glycogen as horses. The glycogen content of certain muscles of the same horse were found to differ, 23.5 per cent more being found in the semitendinosus muscle than in the sternohumeral. In general, however, the rations containing more protein were found to produce a larger store of muscular glycogen.

The relative ability of different feed materials to produce muscular glycogen in rats was expressed as follows: Rice 100, barley 100, cheese 72.4, corn 69, oats 57, lard 44, and beans 32.75. The glycogen content of the muscles expressed as percentage of the glycogen content of the liver varied with the different diets, ranging from 10.2 to 13.54 per cent on a rice diet, 14.8 to 41.3 per cent on a cheese diet, 26 per cent on lard, 6.17 to 9.2 per cent on an oat diet, and 6.4 to 8.2 per cent on a diet of beans. A discussion is given of the desirability of storing glycogen or fat in the muscles. It is mentioned that animals of the draft breeds tend to store fat in the muscles, whereas lighter horses tend to store glycogen. The practical application of the results is also discussed.

Slaughtering of stock, W. C. QUINNELL (*New Zeal. Jour. Agr., 26 (1923), No. 3, pp. 160–167*).—This is essentially a discussion of the different methods of stunning and sticking beef.

Farm meats, M. D. HELSER (*New York: Macmillan Co., 1923, pp. XV+274, pls. 2, figs. 124*).—This is a textbook on methods of killing, cutting, and curing different meats, based on a course of lectures given by the author. Additional information on meat rings, demonstrations, country hides and skins, and methods

of teaching meat courses is also given, as well as the requirements of the Chicago Board of Trade for meat inspection and cutting and packing pork.

Corn substitutes for fattening lambs, I, II, J. M. EVVARD, R. DUNN, and C. C. CULBERTSON (*Iowa Sta. Bul. 210 (1923), pp. 205–229, figs. 11*).—The results of two 90-day feeding experiments in fattening lambs in 1918–19 and 1919–20 are reported. Each year 5 lots of 30 lambs each received a basal ration per lamb of 0.15 lb. of linseed oil meal on the silage once daily, plus corn silage full fed twice daily, clover hay full fed once daily, and block salt self-fed. During both years the different lots of lambs received in addition two full feeds per day of the folowing grains: Lots 1 shelled corn, lots 2 whole oats, and lots 3 whole barley. In 1918–19 lots 4 and 5 received hominy feed and corn gluten feed, respectively, but in 1919–20 mixtures of shelled corn and whole oats and shelled corn and whole barley were fed to lots 4 and 5, respectively. During the first 30 days the mixtures consisted of 1 part corn and 2 of oats or barley, during the second 30 days 1 part of each, and during the third 30-day period 2 parts of corn and 1 part of oats or barley. The following table gives a summary of the results of the experiments:

Summary of 1918–19 and 1919–20 comparisons of feeds for fattening lambs.

Year.	Lot.	Average initial weight.	Average daily gain.	Feed per 100 lbs. of gain.					Shrinkage.	Dressing percentage.	Selling price per 100 lbs.
				Grain.	Linseed meal.	Corn silage.	Clover hay.	Block salt.			
		Lbs.	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Per ct.*	*Per ct.*	
1918–19	1	56.20	0.330	281.40	45.20	630.30	73.50	3.10	8.76	48.46	$20.40
	2	55.90	.360	294.20	41.40	553.50	60.50	3.60	11.28	44.39	19.75
	3	55.40	.360	284.20	41.60	576.10	67.20	3.00	11.75	47.02	20.00
	4	55.60	.300	257.40	50.40	723.10	85.20	4.20	12.13	46.71	19.85
	5	55.50	.330	301.63	44.80	614.20	73.10	3.70	10.51	48.43	20.25
1919–20	1	58.33	.300	353.46	49.67	641.37	62.20	3.29	7.79	50.18	20.90
	2	58.61	.272	442.52	54.77	641.70	64.17	3.75	8.82	47.59	20.84
	3	58.63	.295	396.60	50.60	594.12	60.44	3.28	9.42	49.29	20.93
	4	58.04	.298	384.73	50.03	590.53	60.21	4.65	8.38	49.06	20.73
	5	58.49	.272	407.28	54.75	642.94	65.55	3.25	8.69	50.22	20.94

[Hog feeding experiments at the Indiana Station] (*Indiana Sta. Rpt. 1922, pp. 18, 19, fig. 1*).—In comparing the method of full feeding spring pigs for early fall market with limited feeding for winter market, it has been found that each method requires an equal amount of feed, but the early fall market is usually better.

Tankage has been a valuable addition to corn and clover pasture for growing and fattening hogs in experiments during the last two years. Where clover, rape, and alfalfa grow equally well there is found to be little difference in their value as pasture crops for hogs, but alfalfa seems to have a slight advantage in furnishing a more continuous supply of fresh green forage.

Soy beans and tankage as supplements to corn hogged off have been found to increase gains. Tankage has been most efficient, followed by soy beans grown in the field with tankage fed in a self-feeder. Soy beans grown in the field were not as efficient when no other protein was given as ground soy beans in a self-feeder, but both increased the economy of gains over hogging off corn alone. Little difference has been shown in the rate of gain or feed consumption when corn is hogged off or harvested and fed.

[Hog feeding experiments at the Kentucky Station] (*Kentucky Sta. Rpt. 1922, pt. 1, pp. 49, 50*).—Another year's results are reported of the hog feeding experiments (E. S. R., 48, p. 171).

In two trials buttermilk exposed to the sun's rays for 25 to 30 days in summer did not materially affect the hogs' appetite for milk when fed to them, though it had a very disagreeable odor. Fresh buttermilk contained 0.108 per cent of lactic acid and had a bacterial count of 7,500,000 per cubic centimeter, whereas the stale buttermilk contained 0.954 per cent of lactic acid and 124,900,000 bacteria per cubic centimeter. Average daily gains of 1.38 and 1.43 lbs. were made on rations of corn and stale buttermilk.

In hogging down corn the lot which received a supplement of tankage self-fed was again most profitable. Hogging down corn and soy beans did not produce soft pork.

[Experiments with swine at the Eastern Oregon Substation] (*Oregon Sta. Bien. Rpt. 1921–22, p. 103*).—Tests in growing and fattening pigs on winter rye, winter wheat, pea and oat, pea and alfalfa pasture indicated that alfalfa produced the most economical gains, though they were slightly less than the gains made on wheat and rye pasture. Next to alfalfa the most economical gains were made on peas.

Brood sows in good condition may be carried through the winter on a mixture of 1 lb. rolled barley and 2 lbs. chopped alfalfa. Sows not in such good condition or young sows should receive more barley, and some tankage should be added to the ration a week or 10 days before farrowing.

Hog feeding [at the Umatilla, Oreg., Substation] (*Oregon Sta. Bien. Rpt. 1921–22, p. 86*).—The results of feeding experiments have shown that it is more economical to grow pigs on a 2 per cent ration of corn and middlings than on a self-feeder, but more economical gains were made in finishing pigs on a self-feeder than on a 4 per cent ration.

Supplemental specialty feeds for making 225-lb. pigs on pasture, J. M. Evvard and C. C. Culbertson (*Iowa Sta. Circ. 85 (1923), pp. 3–8*).—In comparing the value of various commercial hog feeds, 16 lots of 5 pigs each weighing about 50 lbs. were selected and self-fed until they reached about 225 lbs. in weight. Lots 15 and 16 were on blue grass pasture, but all others were on rape pasture. Shelled corn was self-fed to all except the one lot which received Sucrene Hog Meal. Block salt was self-fed to all except one lot in which Lictonic replaced it.

The feeds tested and the average daily gains per pig made on each were as follows: Swift's Digester Tankage 1.42 lbs.; 40 parts Swift's Digester Tankage and 60 parts Clinton Corn Oil Cake Meal 1.37, no supplement to the regular ration 0.64; 75 parts Swift's Digester Tankage and 25 parts Wiedemer's Humus 1.4; Lictonic and Swift's Digester Tankage (no salt) 1.46; Amco Hog Balancer 1.24; Sucrene Hog Meal (no corn) 1.04; C. P. R. Special Hog Meal "Grain Balancer" 1.2; Chapin's Korn Saver 1.23; Chapin's Korn Balance 1.33; semisolid buttermilk, hand-fed twice daily, 1 lb. per pig mixed with 3 qt. of water, 1.62; semisolid buttermilk, hand-fed twice daily, 2 lbs. per pig mixed with 3 qt. of water, 1.63; 60 per cent Protein Master Brand Meat Meal Digester Hog Tankage 1.04; 50 per cent Protein Master Brand Meat and Bone Digester Hog Tankage 1.41; no supplement with blue grass pasture 0.73; and Swift's Digester Tankage with blue grass pasture 1.41 lbs.

The essentials of a successful self-feeder for swine, J. M. Evvard, J. B. Davidson, and W. A. Foster (*Iowa Sta. Bul. 208, abr. ed. (1922), pp. 32, figs. 26*).—An abridged edition of Bulletin 208 (E. S. R., 48, p. 767).

Swine raising in Hawaii, F. G. Krauss (*Hawaii Sta. Bul. 48 (1923), pp. 11+43, figs. 26*).—The swine industry in Hawaii is described and the principles of swine feeding and management are briefly outlined, with descriptions of the practices at the Haiku Substation and on certain ranches. The more common

parasites and diseases of swine are briefly discussed and remedies are suggested.

Size, sex, and weight of pigs per litter (*Kentucky Sta. Rpt. 1922, pt. 1, pp. 46, 47*).—Records of 186 sow pigs and 181 boar pigs born on the station farm showed the following averages for the different breeds: Number of pigs per litter, Duroc-Jersey 9.2, Berkshire 8.8, Hampshire 8.7, and Poland China 10; average weight of sow pigs at birth, Duroc-Jersey 2.35, Berkshire 2.66, Hampshire 2.52, and Poland China 2.14 lbs.; the average weight of boar pigs at birth, Duroc-Jersey 2.34, Berkshire 2.7, Hampshire 2.58, and Poland China 2.9 lbs.

Soft pork investigations (*Georgia Sta. Rpt. 1922, pp. 10, 11, 12, figs. 2*).—Additional tests of methods of hardening soft pork (E. S. R., 47, p. 475) have shown "that hogs receiving peanuts alone two months were soft, and that a finishing period of two months on corn and tankage or corn and cottonseed meal was not sufficient to overcome the softness entirely."

Corn and tankage produced less gains in finishing peanut-fed hogs for two months than in finishing hogs that had not received peanuts. None of the rations fed were satisfactory for hardening soft pork in two months. The greatest gains were made on the rations of peanuts, corn, and tankage. A preliminary study of the effect of unbalanced rations on the hardness of pork fat have shown that with ¾ lb. of butter fat per day in the ration over a three-month period, a hard and firm pork fat was produced.

[Experiments by the department of poultry husbandry at the Indiana Station] (*Indiana Sta. Rpt. 1922, pp. 39–42, figs. 2*).—The results of several experiments are reported.

Can soy bean oil meal be substituted for tankage?—Six lots of 30 Barred Plymouth Rocks each were fed a basal ration, with the addition of tankage or soy bean meal or both in varying proportions in the different lots. Some steamed bone was added to the ration of one lot receiving only soy bean meal as the supplement. The average egg production per bird varied from 143.5 for the lot receiving tankage to 38.6 for the lot receiving soy bean meal without the mineral supplement. Since the lot receiving soy bean meal and mineral supplement produced only 40.3 eggs per bird, the lack of minerals in soy beans does not seem to have been the cause of the difference in the production as compared with tankage unless steamed bone is an inadequate source of minerals. Two lots of White Leghorns gave similar results.

Initial weight of chicks influences growth and mortality.—In a study of the factors involved in feeding chicks, observations have shown that the larger chicks at the beginning of the experiment made greater gains and had a lower death rate. The experiments indicate that the excessive death rate at from 6 o 10 weeks of age, due to bacterial activity in the digestive tract, may be reduced by the use of rations of a high fiber content.

Hatches improved by correct temperatures in incubators.—As in earlier tests (E. S. R., 47, p. 176), a temperature of 101° F. for incubation gave the best results.

[*Artificial illumination*].—A pen of birds which had electric lights from 8 to 9 p. m. laid slightly more eggs in the fall months, consumed a little more feed, and had a little lower mortality than a pen receiving no light. A pen lighted from October 1 laid 137.2 eggs per hen during the year as compared with 141.4 eggs laid by a pen which did not receive light until January 1. The profits were greater, however, in the fall lighted house because more eggs were laid during October, November, and December.

Germ of corn supplies essential nutrition.—It was found that cockerels fed entirely on "pearl" hominy, which consists of the starchy part of the corn

kernel, developed leg weakness in about 3 weeks. A ration of corn germ remedied the defective condition in 3 days. Other birds receiving some corn germ did well and maintained weight for several weeks.

[**Poultry experiments at the Kentucky Station**] (*Kentucky Sta. Rpt. 1922, pt. 1, pp. 41, 42*).—Two experiments to increase egg production are reported.

The feeding of skim milk and semisolid buttermilk to poultry.—A second year's results in the experiment in feeding skim milk and semisolid buttermilk to laying hens have corroborated the first year's results (E. S. R., 46, p. 770). White Wyandotte pullets averaged the following numbers of eggs on the different rations: Mash plus meat scrap 150.5, mash plus skim milk 145, skim milk and no mash 155.5, mash plus semisolid buttermilk 144, and semisolid buttermilk with no mash 152. Hens averaged 113.2 eggs on the mash plus meat scrap ration and 106.7 eggs on the skim milk and no mash ration. The pullets consumed sour skim milk daily at the rate of 1 gal. per 32 birds. When sour skim milk or semisolid buttermilk is fed as a source of protein, it was concluded that it is unnecessary to feed dry mash.

Effect of artificial illumination on egg production.—In a third year's test of this experiment (E. S. R., 46, p. 875) a higher winter egg production of 3.1 eggs for pullets and 18 eggs for hens was obtained with artificial light.

[**Poultry feeding experiments at the New Mexico Station**] (*New Mexico Sta. Rpt. 1922, pp. 28, 29*).—Five pens of 7 hens and 23 pullets were compared as to their egg production when receiving mash composed of different combinations of feeds. The mash in pen 1 consisted of 100 lbs. of ground corn, 100 lbs. of bran, and 50 lbs. of tankage (60 per cent protein); pen 2 200 lbs. of bran, 100 lbs. of ground corn, 100 lbs. of ground oats, and 100 lbs. of tankage; pen 3 bran only; pen 4 bran and tankage, self-fed separately; and in pen 5 200 lbs. of ground corn, 100 lbs. of ground oats, and 100 lbs. of tankage. Each pen received the same scratch feed. The average egg production per bird for the 10 months from December to September was for pen 1 160, pen 2 125.4, pen 3 108.3, pen 4 90.9, and pen 5 136.6. In each case the egg production was proportional to the feed consumption.

Feeding for egg production, H. L. Kempster (*Missouri Sta. Circ. 111 (1923), pp. 12, figs. 4*).—A discussion of feeds and principles of feeding for egg production.

The color of some poultry breeds, E. Ladebeck (*Ztschr. Induktive Abstam. u. Vererbungslehre, 30 (1922), No. 1–2, pp. 1–62, figs. 38*).—This is a study of color and pigmentation in poultry. The breeds used consisted mostly of the Jungle fowl (*Gallus bankiva*), Partridge Leghorns, Red Sussex, and Yellow Cröllwitz, but Rhode Island Reds, Light Sussex, Barred Rocks, and Minorcas were also used in some cases. The feathers were fixed and sections made for microscopical studies, and chemical studies were made of the nature of the pigments. The work is reported in three parts.

The first part deals with the morphology of feathers and feather pigments, and consists of a microscopical examination of the feathers and the shape and arrangement of the pigments in feathers from different breeds and sexes and from different parts of the birds. The pigment causing dark brown or black was found to be in the form of rod shaped or elliptical bodies in the laminae, whereas the red and red brown colors were due to fine granular pigment, and the yellow was due to irregularly arranged pigment of a finer granular nature or more diffuse. These color differences are more gradual in the Jungle fowl and in the Leghorn, but the distinction between them is more marked in the Sussex, Rhode Island Red, and Cröllwitz breeds. Other differences in the pigment arrangement and form in the feathers are also discussed.

The second part of this study deals with the chemical nature of the pigment, which was determined as melanin. The black and red pigments behaved differently in solubility, the red being more soluble in weak alkalis than the black. Both types contained some iron, but less was present in the red pigment.

The third part of the study deals with the coloration of the comb, ear lobes, and legs.

Inheritance studies with poultry (*Rhode Island Sta. Bul. 193 (1923), p. 15*).—Crosses between Cornish and Hamburgs developed much faster than the Hamburg and as fast as the Cornish breed.

Experiments on close inbreeding in fowls.—A preliminary report, L. C. DUNN (*Connecticut Storrs Sta. Bul. 111 (1923), pp. 139–172*).—An account of three years' experimental work in inbreeding six lines of White Leghorns by brother and sister matings is given. The parental stock was selected by breeding a brother to his full sister in each line in 1920. The offspring of the hen having the largest number of daughters and 2 sons on February 1 of the following year were used for continuing the line each year, but records were kept on all females. The eggs used for hatching were those laid after March 15, and the birds were hatched between April 15 and May 15 in incubators. The regular flock, in which close inbreeding was avoided, were used as controls. The records kept for each line to denote the vigor in succeeding generations are summarized in the following table for inbred and control stock:

Summary of the records kept on the inbred lines and the control birds.

AVERAGE OF INBRED LINES.

Generation.	Eggs set.	Hatched.	Growth rate to 3 weeks.[1]	Mortality to 3 weeks.	Reproductive index.[2]	Age of laying first egg.	Production.		Adult mortality.	Egg weight.
							Winter.	Annual.		
	No.	*Per ct.*		*Per ct.*		*Days.*	*Eggs.*	*Eggs.*	*Per ct.*	*Gm.*
P_1	149	76.8	[3] 3.23	3.6	35.0	[3] 220.0	32.2	152.3	23.7	56.3
F_1	616	49.2	.....	19.4	15.8	259.7	9.9	86.9	38.2	55.0
F_2	884	42.1	2.03	17.4	15.3	276.0	5.7	[4] 41.6	[4] 56.3	52.5
F_3	449	21.7	1.91	24.7	3.7	.....	.....	.....	.....	.....

AVERAGE OF CONTROL FLOCK.

P_1	1,416	51.6	[3] 3.23	9.4	[3] 30.0	[3] 220.0	36.0	149.0	25.7	.....
F_1	562	49.8	.....	10.0	25.9	234.3	17.5	121.8	28.8	.....
F_2	433	64.6	2.24	10.9	34.5	242.3	18.0	[4] 89.7	[4] 59.5	.....
F_3	809	60.8	2.36	5.8	34.0	.....	.....	.....	.....	.....

[1] Weight at 3 weeks divided by birth weight.
[2] Number of live chickens at end of 3 weeks divided by the number of days eggs are saved for hatching.
[3] Estimated.
[4] Effected by an epidemic of intestinal worms and parasites.

The individual inbred lines showed some variation as regards different characteristics. This was especially true in the case of the egg size, but in most characters there was in general a rather uniform decline in all lines. The author discusses the results as follows:

"Close inbreeding of White Leghorn fowls (brother×sister) in several lines for three generations has resulted in a marked and general decline in the percentage of eggs hatched and the number of eggs laid in the first (pullet) year, a rise in the mortality rate of both chicks (to three weeks of age) and adult pullets, a decrease in the rate of growth of chicks (to three weeks) and

probably at later periods, a delay in the attainment of maturity as measured by date of first egg and winter egg production, and probably a general slowing down in the rate of most of the vital processes. The efficiency of reproduction has declined from a rate more than ample to perpetuate the lines to a point at which no increase can take place, and which represents less than the minimum margin of maintenance. The size of eggs has apparently declined on the average, but this is found to be due probably to the segregation of small size in two lines and of large size in only one line."

The value of various culling factors, G. W. HERVEY (*New Jersey Stas., Hints to Poltrymen, 11 (1923), No. 9, pp. 4*).—A discussion of the correlation of various body characters and pigmentation with egg production and their value for culling poultry.

Raising males to head the breeding flocks, MR. and MRS. G. R. SHOUP (*Western Washington Sta. Bimo. Bul., 11 (1923), No. 2, pp. 29–33, figs. 2*).—A discussion of a method of handling young cockerels to be used in the breeding pens.

The systematic location of genes by means of crossover observations, R. A. FISHER (*Amer. Nat., 56 (1922), No. 646, pp. 406–411, fig. 1*).—This is a discussion of the method of locating the genes in chromosomes, based on the amount of crossing over which occurs. Certain suggestions as to the application of this method are given, including a formula for use in calculating the location of the genes when a number of factors are taken into consideration.

DAIRY FARMING—DAIRYING.

The feed cost of milk and fat production as related to yields, H. A. ROSS, H. F. HALL, and C. S. RHODE (*Illinois Sta. Bul. 244 (1923), pp. 552–573, figs. 3; abs. ed., pp. 4*).—This is a study of the feed cost of milk and fat, based on the yearly records of 1,605 Holstein cows over 3 years of age from 15 cow testing associations in Illinois. These records were collected during a 4-year period, 1917 to 1920. The cows were classified according to their yearly milk and fat production, the classes differing by 25 lbs. for fat and 1,000 lbs. for milk. The average of the classes for fat varied from 93 to 559 lbs. and for milk from 3,081 to 16,711 lbs. The amount of concentrates, succulent feeds, and dried forage required to produce 1 lb. of fat or 100 lbs. of milk was then tabulated for the cows of the different classes, and it was determined that the amount of concentrates required to produce a unit amount of fat or milk was rather constant for the animals in the different classes. The amounts of succulent feed and dried forage, however, were greater in cases of lower production, as was also true of the calculated consumption of digestible nutrients. Correlations between the digestible nutrients consumed per pound of fat and per 100 lbs. of milk produced with annual production of the cows were, respectively, -0.4570 ± 0.0133 and -0.4180 ± 0.0139.

The formulas below were presented for calculating the amount of digestible nutrients required to produce 1 lb. of fat or 100 lbs. of milk, based on the annual production of the cows:

$$Y=\frac{2584.22}{X+48.06}+5.18 \qquad Y=\frac{3651.60}{X+36.75}+14.95.$$

In the first formula Y represents the pounds of digestible nutrients consumed per pound of fat produced, and in the second formula it represents the pounds of digestible nutrients consumed per 100 lbs. of milk produced. X equals the annual fat or milk production in the respective formulas.

In estimating the amount of nutrients which the animals consumed from pasture which were not included in the above discussions, the authors have calculated the amount of nutrients required by the animals producing the different amounts of milk according to Haecker's standard, and has found that only about 65 per cent of the required feed has been consumed in the rations, indicating that 35 per cent of the nutrients were secured from pasture. They mention that these results were obtained from actual normal production, and similar results would probably not be obtained in case of forced production for high records.

Relation of the composition of rations on some New York dairy farms to the economics of milk production, E. G. MISNER (*New York Cornell Sta. Mem. 64 (1923), pp. 5–46, figs. 19*).—This is the report of a study of the composition of rations fed to dairy cattle and their relation to the quantity and economy of milk production, based partly on data accumulated in the study of dairying on 149 Broome County farms (E. S. R., 47, p. 578), but mainly on a similar study of 163 farms in Herkimer County, New York, comprising 4,136 cows (not yet published).

The study deals largely with the effect on milk production of the protein-energy ratio of the total ration, the concentrates, the silage, or the dry forage. The protein-energy ratio is the relation of the pounds of digestible crude protein to the total therms of net energy in the ration. The composition of the feeds were calculated from common tables of average feed analyses. Data are given in detail for the Herkimer County results, but only where noted for Broome County. Tables are presented to show the relation of the various factors to economic production, and correlation coefficients have been calculated between the protein-energy ratio of the winter ration and the following factors: Amount of milk sold wholesale per cow in winter -0.523 ± 0.038, annual milk yield per cow -0.389 ± 0.045, cost per 100 lbs. of milk sold per cow in Herkimer County $+0.253\pm0.049$ and in Broome County $+0.241\pm0.052$, profit or loss per cow (both Herkimer and Broome Counties) -0.287 ± 0.035, percentage of wholesale milk sold from November to April -0.485 ± 0.048, percentage of cows freshening from September to December, inclusive, -0.317 ± 0.048, profit per cow in Herkimer County -0.300 ± 0.048 and in Broome County -0.333 ± 0.049, and pounds of milk sold wholesale per cow in stabling period (for herds producing over 45 per cent of the total year's milk yield in stabling period) -0.465 ± 0.100.

Other correlation coefficients calculated included percentage of digestible crude protein in concentrates fed in the winter and milk yield per cow for the year $+0.300\pm0.048$, percentage of market milk sold wholesale in the winter and milk produced per year per cow $+0.392\pm0.045$, pounds of milk sold wholesale per cow in the winter and percentage of cows freshening from September to December inclusive $+0.602\pm0.034$, number of cows per farm and cow cost of milk sold wholesale per 100 lbs. -0.268 ± 0.049, and amount of milk produced per cow and cow cost of milk sold wholesale per 100 lbs. -0.480 ± 0.041.

Since many factors are operative in effecting economy of milk production, the following correlation coefficients were calculated with the effect of a third variable eliminated according to a formula by G. U. Yule: Correlation between protein-energy ratio of winter ration and milk yield per cow for the year, with the influence of the percentage of milk sold in the winter period eliminated, -0.247 ± 0.05; correlation between the milk yield per cow for the year and percentage of milk sold in the winter period, with the effect of the protein-energy ratio of the winter ration eliminated, $+0.252\pm0.05$; correlation between the protein-energy ratio of the winter ration and milk sold wholesale per cow

in the winter period, with the influence of fall freshening eliminated, -0.439 ± 0.043, and correlation between milk sold wholesale per cow in the winter period and percentage of cows freshening from September to December, inclusive, with the influence of the protein-energy ratio of the winter ration eliminated $+0.540 \pm 0.037$.

The author emphasizes the importance of the high protein content of the ration for economic milk production, as indicated by the high correlation coefficients even when so many factors are operative.

A comparison of roughages for milk production, A. C. McCandlish and E. Weaver (*Iowa Sta. Bul. 212 (1923), pp. 273–286*).—Three experiments for comparing different roughages for milk production were caried on under the same general plan as experiments with dairy cattle previously noted (E. S. R., 47, p. 479).

In the first experiment corn fodder and corn silage were compared, in the second alfalfa and timothy hay, and in the third experiment corn silage and alfalfa hay were compared with corn fodder and timothy hay. Four cows were used in the first experiment and 5 in the second and third experiments. The grain ration consisted in the first experiment of cracked corn, ground oats, wheat bran, and linseed oil meal in the proportions of 2:1:1:1, and in the second and third of cracked corn, ground oats, and oil meal in the proportions of 4:4:1. A summary of the milk and fat production and the feed consumed by the cows follows:

Comparative tests of roughages for milk production.

Experiment.	Period.	Roughage tested.	Average live weight.	Production.		Feed consumed.		
				Milk.	Fat.	Corn silage.	Alfalfa hay.	Grain mixture.
			Lbs.	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*
1	1 and 3	Corn fodder	1,123	2,273	72.3	[1] 1,785	468	771
	2	Corn silage	1,137	2,399	74.1	2,745	478	780
2	1 and 3	Alfalfa hay	891	1,865.9	94.7	2,325	566	720
	2	Timothy hay	896	1,746.7	87.66	2,357	[2] 523	720
3	1 and 3	Alfalfa hay and corn silage.	904	2,063.2	86.15	2,503	544	663
	2	Corn fodder and timothy hay.	882	1,697.3	73.55	[1] 853	549	663

[1] Corn fodder. [2] Timothy hay.

Sunflower silage [for milk production] (*Georgia Sta. Rpt. 1922, p. 10, fig. 1*).—"Sunflower silage proved about equal in value to corn silage for the production of milk and butter fat. The iodin number and refractive index of butter fat were slightly higher on the sunflower silage ration."

Peanut feed for dairy cows (*Georgia Sta. Rpt. 1922, p. 9*).—As in an earlier test (E. S. R., 47, p. 480), the heavy feeding of peanuts and peanut meal to dairy cows has been found to produce a harder butter fat than when wheat bran is fed. In another test, a ration containing peanut oil was fed in comparison with a ration containing butter fat. The butter fat ration increased the milk production, but the fat percentage remained constant. The peanut oil seemed to harden the butter fat.

Dairy investigations [at the Astoria, Oreg., Substation] (*Oregon Sta. Bien. Rpt. 1921–22, p. 80*).—In comparisons of the value of feeding grain to dairy cows while on pasture, it was determined that the profit from feeding grain with pasture may be realized the following fall by having the animals

in better condition to start the winter. Feeding soiling crops during the summer months resulted in a 15 to 20 per cent increase in milk production.

[**Feeding and wintering dairy heifers in Indiana**] (*Indiana Sta. Rpt. 1922, pp. 23–25, fig. 1*).—In studying the ration and methods of wintering dairy heifers, it was found that heifers housed in a barn gained nearly 0.3 lb. per day more than heifers housed in an open shed. Heavy feeding of heifers during the winter seems to be uneconomical, as an extra amount of feed is used without corresponding gains being produced.

The effect of feeding different rations to calves was studied on 12 heifers until they had gone through one lactation period. It is concluded that the feed during the first six months of the calf's life did not have any great effect on the production, but that the size of the heifers was affected. The 1919 heifers did not make good growth to 18 months of age, but after this time when receiving heavy feed they made gains of 1.36 lbs. per day, consuming large amounts of feed in making this gain.

Wintering dairy heifers (*Oregon Sta. Bien. Rpt. 1921–22, p. 35*).—In continuing the study previously noted (E. S. R., 44, p. 871) in wintering dairy heifers, 2 lots of 8 one to two-year-old heifers received oat and vetch hay and corn silage and one lot received a grain ration in addition. Both groups received all the hay and silage they would consume, but the lot receiving grain made average gains of 369 lbs. in weight as compared with 134 lbs. for the lot receiving no grain. Neither group was excessively fat. The necessity of grain in the ration of dairy heifers is thus indicated.

Raising calves on milk substitutes (*Oregon Sta. Bien. Rpt. 1921–22, pp. 32, 33*).—Experiments were carried on in raising 20 calves on rations consisting of 100 lbs. of mill run, 100 lbs. of ground barley, 50 lbs. of ground red clover hay, and 40 lbs. of oil meal or rations in which the oil meal, red clover hay, or both were replaced by soy-bean meal and oat and vetch hay, respectively. These rations were not successful milk substitutes for the calves, as 9 of the 20 died during the test and it was necessary to feed milk to the others to save them. A previous test had indicated that young calves could handle this ration. The 11 calves which survived were kept on the experiment 233 days, during which time they gained an average of 200.7 lbs. in weight and 21.5 cm. in height at withers. The calves, however, have not been in good condition.

Official testing of dairy cattle in Oregon, H. N. Colman (*Oregon Sta. Circ. 41 (1923), pp. 38*).—This consists mainly of a description of the method of conducting official tests of the different cattle breeds and the rules and regulations governing official testing as adopted by the American Dairy Science Association for conducting tests in the United States.

[**Milking machine experiments**], T. M. Olson (*South Dakota Sta. Rpt. 1922, pp. 29, 30*).—Milking machine studies (E. S. R., 47, p. 480) have been continued, and it has been found that it requires about 8½ minutes to milk an average cow. There seems to be no injury to the cow when ordinary precautions are taken. Strippings varied in amount from 0.1 to 2 lbs. for the same cows at different milkings. Fifteen or more cows should be kept before a mechanical milker will be a timesaving investment.

Effect of composition on the palatability of ice cream, O. E. Williams and G. R. Campbell (*U. S. Dept. Agr. Bul. 1161 (1923), pp. 8, figs. 3*).—In testing the effect of the composition of ice cream on its palatability, four independent tests were carried on to determine the preference of the Department employees for ice cream varying in its content of fat, milk solids not fat, sugar, and gelatin.

In testing each ingredient, three ice-cream mixes were used, the testers being allowed to compare all samples on the first day and then choose the one most desired the succeeding days during 3 or 6 week periods.

In choosing for fat, 82 per cent selected ice cream with 18 per cent fat, 10.4 per cent selected for 15 per cent fat, and 7.6 per cent for 12 per cent fat. In case of the sugar, 61.4 per cent of the preferences were for ice cream containing 19 per cent sugar, 28.4 for 16 per cent sugar, and 10.2 per cent for 13 per cent sugar. The variations in milk solids not fat were 12, 9, and 6 per cent, and the preference for each kind 56.1, 25.7, and 18.2 per cent, respectively. As regards gelatin, 63.2 per cent chose ice cream containing 1 per cent gelatin, 13.8 per cent chose 0.5 per cent gelatin, and 23 per cent chose ice cream with no gelatin.

In another test to study the influence of the fat content on the quantity eaten, groups of 5 to 7 persons were given all the ice cream containing 10 or 15 per cent fat that they would eat and the average amount eaten determined. This was repeated six times for each kind of ice cream. An average of 341 gm. of the ice cream containing 10 per cent fat was consumed as compared with 317 gm. of the ice cream containing 15 per cent, from which it is concluded that unless the ice cream is very rich, the fat content does not have a great effect on the quantity a person will eat.

A study of physical, chemical, and bacteriological factors causing sandiness in ice cream (*Indiana Sta. Rpt. 1922, p. 26*).—The study of the cause of sandiness in ice cream (E. S. R., 47, p. 180) has been continued, and it is stated that when the percentage of lactose in the water content of ice cream exceeds 10 per cent sandiness invariably occurs.

VETERINARY MEDICINE.

[Report of the Indiana Station] department of veterinary science (*Indiana Sta. Rpt. 1922, pp. 55–58, figs. 2*).—Hog cholera exposure experiments were conducted in a bluegrass pasture, in which spaces 4 and 8 ft., respectively, separated the diseased from healthy or control pigs. Visible symptoms of cholera were manifested by the controls on the sixteenth and nineteenth day. In a small house divided into two pens by cheesecloth partition placed in the middle of a 3-ft. space enclosed by chicken wire, cholera and healthy control pigs were placed. All of the cholera pigs died, but the controls were well on the thirty-third day. Feces and urine collected from cholera pigs killed five days after they were inoculated with cholera blood and showing visible symptoms did not produce cholera when fed to susceptible pigs. Of two lots of susceptible pigs fed feces collected from a pig killed seven days after inoculation, one pig developed the disease.

"A series of feeding experiments have proved that the virus of dysentery of swine is present in the stomach and colon and absent in the lungs, spleen, liver, kidneys, and heart. Post-mortem examinations of several hundred cholera hogs inoculated with 2 to 3 cc. of virus showed that hemorrhagic lesions occur as early as the fifth day, and intestinal ulcers as early as the ninth day following inoculation." Tests of serum and virus are briefly referred to.

Brief reference is made to feeding tests of white snakeroot (*Eupatorium urticefolium*), which is responsible for outbreaks of trembles, in one herd 9 out of 11 head of cattle having died. A brief account of this plant is given in the circular noted on page 584. Tests of a white mold, *Diplodia zeae*, which occurred on corn used in feeding experiments, failed to indicate any toxic effect.

[Work with live-stock diseases in Kentucky] (*Kentucky Sta. Rpt. 1922, pt. 1, pp. 43, 44, 45, 46, 47–49, 50, 51*).—With the view to determining whether

an aborting cow will carry each succeeding calf a longer period until finally one is carried for the full period, as has been reported, tabulations were made of all abortions in a herd for 26 years. This tabulation, which included 22 dairy cows that aborted 48 out of 121 calves, shows that there is no rule as to the length of time an aborting cow will carry each succeeding calf.

During the year 648 mares in 27 different herds were immunized against infectious abortion, with perfect results so far as could be determined. In the immunization of mares four doses of vaccine were used 7 days apart. In investigations of sterility in mares, in which bacteriological examinations were made of 200 living animals, 102 were found to be free from microorganisms.

"Of the 98 mares showing infection, as determined by cultural methods and clinical study, 40 showed a Streptococcus. From 11 of the 40, a Streptococcus was isolated in pure culture, the remaining 29 showed a Streptococcus in combination with 1 or more other kinds of microorganisms. The various combinations in which the Streptococcus was found and the number of times each occurred are indicated in the following list: *S. genitalium nocens* in pure culture 11; Streptococcus and *Bacillus coli* 1; Streptococcus, *B. coli*, and *Micrococcus pyogenes albus* 4; Streptococcus and an unidentified rod of the colon-typhoid group with wrinkled colony 1; Streptococcus and chromogenic cocci 4; Streptococcus and 3 or more of the following organisms, *B. coli*, *M. aureus*, *M. roseus*, rod with wrinkled colony and *M. simplex* 6.

"The Streptococcus isolated from the uteri of 40 mares and designated *S. genitalium nocens* has been found also in the semen of stallions, in aborted fetuses, in colts born dead, and in colts that have died in the first few days of life. The streptococci are hemolytic and do not stain by Gram's method. In the water of condensation, where they grow most abundantly, they occur in long tangled chains consisting of hundreds of elements. Their action on carbohydrates is the same as that of *S. pyogenes* as described by Holman, in that they ferment lactose and salicin but do not ferment mannit. A small quantity (0.25 cc. from the water of condensation) of a 24-hour culture, when injected intravenously, kills a large rabbit in from 18 to 24 hours.

"In the other 58 mares found to have a uterine infection, no one particular microorganism seemed to predominate. The microorganisms isolated from the fetuses and colts include *B. coli*, *M. pyogenes albus*, *B. viscosum equi*, a number of colon-typhoid bacilli, and a nonhemolytic Streptococcus. The results do not indicate any direct relationship between the bacteriological findings of the mares and those of the colts and fetuses. The isolation of *B. viscosum equi* from one of the colts is of particular interest, inasmuch as it has never before been reported found in this country." It is pointed out that Magnusson reported the isolation of *B. viscosum equi* from 30 per cent of the cases of joint-ill studied in Sweden (E. S. R., 42, p. 679).

A study was made of 15 herds of swine, with from 7 to 100 brood sows each, in the field where abortion varying from 5 to 100 per cent occurred under natural conditions. The results following vaccination of the sows and boars in 14 herds, in which the animals received at least three and sometimes four injections of the bacterin, were fairly satisfactory, but were in no way conclusive as to the necessity or value of vaccination of sows against abortion. The results obtained in one herd seem to indicate that swine do not become resistant to abortion infection following one abortion, but do become resistant after the second or third abortions.

A brief report on laboratory and field diagnosis of animal diseases is included.

[Report of the Oregon Station] departments of veterinary medicine and bacteriology (*Oregon Sta. Bien. Rpt. 1921–22, pp. 38–42, 61, 62*).—The work

reported upon deals chiefly with the methods of spread, etc., of infectous abortion. Brief accounts are given of studies during the year of hemorrhagic septicemia and infectious mastitis of cattle. Flushing out with water the digestive tube of poultry fed canned corn previously innoculated with *Bacillus botulinus* seemed to have considerable curative value if given in the early stages.

The spring rabbit brush (Tetradymia glabrata), a range plant poisonous to sheep, C. E. FLEMING, M. R. MILLER, and L. R. VAWTER (*Nevada Sta. Bul. 104 (1922), pp. 29, figs. 11*).—This is a summary of investigations conducted by the station, consisting largely of feeding experiments, presented in large part in tabular form. The spring rabbit brush is a common poisonous plant in the foothills of Nevada and several other Western States.

"In late summer, autumn, and winter it is a leafless gray brush, stiff and dense but not spiny, from 1 to 4 ft. high. In the spring it puts out a tender growth of light-gray stems and short, slender, fleshy green leaves with clusters of oblong greenish white buds, which bloom into small fuzzy yellow flowers in May. Sheep do not like the spring rabbit brush and will not eat it unless they are hungry; then they will eat the tender new growth if other feed is scarce. A mature range sheep can eat moderate quantities of this plant, up to nearly 2 lbs., without apparent harm, but the poison is only slowly thrown off and if even a little of the plant is eaten every day it will accumulate in the body finally causing severe sickness or death.

"The poisoned sheep stops eating and begins to drool a little. It becomes restless and walks about, a few steps forward and a few back, and may stand for a time holding its head against a fence or other convenient object. The heart beats rapidly, but there is very little fever. The muscles twitch on the neck and shoulders, the animal walks unsteadily, staggers, and goes down. It may lie for hours, growing more dull and indifferent to its surroundings. The breathing is difficult and irregular; the unconscious animal finally dies without spasms or struggle, so quietly that a close watch must be kept if the observer is to record the time of death. When a sheep has been fatally poisoned by small quantities of the plant eaten daily for 10 days or more, death follows the first symptoms of illness within 10 to 18 hours. But when a fatal dose has been taken in a single feeding, the illness is more prolonged, and death does not occur until the animal has been ill for from 24 to 36 hours; it may even linger for 3 days.

"After death the body gives evidence of severe inflammation of the stomach and intestines, with hemorrhages under the skin of the face and neck and under portions of the membrane covering the heart, together with some inflammation of the kidneys, congestion of the lungs, and degenerative changes in the heart and liver. These conditions, however, are not characteristic of poisoning by the spring rabbit brush alone, but when they occur and a strong odor of the plant is noticed on opening up the body of the sheep there is good reason for thinking that this plant is the cause of the trouble. Experiments have shown that the essential oil which gives the brush its odor does not contain the poisonous principle. There is also an unusual quantity of potash salts in the buds and green growth, but careful tests have shown that poisoning is not due to the potash. The active poisonous principle of the plant has not been discovered.

"There is no known remedy for poisoning by the spring rabbit brush. Methods of treatment tested have proved unsuccessful. Poisoning by this plant may occur around dipping plants, shearing corrals, or shipping points, or wherever there are hungry sheep on ranges where the spring rabbit brush is plentiful and good feed is scarce, or when late snows on spring ranges cover the

grasses and tender plants, leaving the brush exposed. Poisoning may be prevented by keeping hungry sheep off ranges where there is little or nothing but the spring rabbit brush."

The low larkspur (Delphinium andersoni), a plant of the spring range poisonous to cattle, C. E. Fleming, M. R. Miller, and L. R. Vawter (*Nevada Sta. Bul. 105 (1923), pp. 22, pl. 1, figs. 8*).—This is a report of investigations of a common poisonous plant of the spring range in eastern Oregon, California, and Nevada. It is poisonous to cattle, but not to sheep, and causes the death of many steers and cows every spring.

"It is closely related to the larkspurs grown in flower gardens and has much the same appearance. The leaves seem ragged because they are made up of irregular divisions radiating from the center. The plants come up very early in the spring in little green clumps of leaves here and there among the rocks and sagebrush. Later in the spring the deep-blue flowers shoot up above the leaves in one or more spikes from 12 to 18 in. high. They go to seed, and the plant then dies down to the ground in the warm days of early summer, but comes up again from the same root for several years. This larkspur grows in sandy or gravelly soil in the sagebrush country of the foothills and the lower slopes of the mountains.

"There is no known cure for poisoning by the low larkspur; in fact, the dose which causes illness is so nearly the fatal dose and the action of the poison is so prompt that there is usually little opportunity for the administration of remedies. Experimental feedings to steers showed that it takes from 20 to 25 lbs. of the leaves and flowers of this larkspur to poison seriously or to kill a 1,000-lb. animal in good condition. Weak and half-starved cattle are probably poisoned by considerably smaller quantities. Most of the cases of poisoning by this plant are due to the fact that the ranges where it grows have been overgrazed and overstocked to such an extent that the cattle are obliged to eat worthless or poisonous plants or else go hungry. Normal cattle in good health ordinarily prefer grass to larkspur. The only hope of prevention is in giving the grass a chance to come back on any overgrazed foothill ranges which may be under control and in keeping weak and hungry cattle off larkspur ranges in the early spring."

Analyses for alkaloidal content and clinical records of feeding tests and remedial treatment with arocolin hydrobromid and atropin are appended.

Woolly-pod milkweed: A dangerous stock-poisoning plant, C. D. Marsh and A. B. Clawson (*U. S. Dept. Agr., Dept. Circ. 272 (1923), pp. 4, fig. 1*).—This is a preliminary report of investigations of *Asclepias eriocarpa*, which, so far as known, grows only in California and in that State is confined to the western portion, except in southern California, where it occurs across the full width of the State. The account is based upon a series of feeding experiments conducted during the summer of 1922, the results of which will be published in detail in a later account. The present circular is issued so that stock owners of California can be on their guard and perhaps prevent some serious losses. The losses ascribed to the woolly-pod milkweed have been almost entirely of sheep, but experimental work has shown that it is equally poisonous to cattle and presumably would poison horses if they could be induced to eat it.

"The first and perhaps the most marked symptom of poisoning is depression, which is shown in the lowered head and humped back of the animal. This depression is followed by weakness, the poisoned animal lying down most of the time. The severely poisoned animals have a marked diarrhea and a complete loss of appetite during the time of the illness. The effects of the plant come on ordinarily only after a considerable period of time succeeding the feeding.

This period averages as much as 16 hours, and the illness continues, in those that recover, for 2 days or more."

The work has shown the plant to be extremely poisonous; less than 2 oz. may poison a sheep of average size and 3 oz. may kill such an animal. At the present time no effective remedies for the poison are known, and the main reliance must be placed upon prevention rather than cure.

Two common weeds that cause death, A. A. HANSEN (*Indiana Sta. Circ. 110 (1923), pp. 8, figs. 4*).—This consists of brief popular accounts of white snakeroot (*Eupatorium urticaefolium*) and water hemlock (*Cicuta maculata*).

Serological factors of natural resistance in animals on a deficient diet, G. H. SMITH and I. M. WASON (*Jour. Immunol., 8 (1923), No. 3, pp. 195–200, fig. 1*).—In order to compare the resistance to infection of normal rats with those maintained upon an incomplete diet, the rats which had been used in the study by Powers et al. of the prevention of rickets by radiation from a mercury vapor lamp (E. S. R., 47, p. 567) were compared with normally-fed animals of a similar weight with respect to the complementing activity and bactericidal action of their blood serum and the ability to stimulate phagocytosis with heterologous leucocytes. In all cases the blood was taken aseptically from the jugular vein, complement titrations were made in an antisheep system, the bactericidal action was determined for *Bacillus typhosus*, and the bacteriotropic activity for *Staphylococcus aureus* with human leucocytes and guinea pig complement was estimated. The results obtained are plotted as graphs representing in the case of the complement titration the averages of each group and in the other tests values obtained with the individual animals.

The sera from the animals which had been maintained upon the rickets-producing diet, whether actually showing rickets or failing to do so because of radiation, showed a marked difference from the animals on the normal diet in the bactericidal titers, the values of the most active sera being considerably lower than the lowest values in the normal animals. The phagocytic indices, although showing considerable variation within the group, were in general lower among the animals fed on the deficient diet. No significant differences were obtained in the complement titrations.

The spread of bacterial infection; some general considerations, W. W. C. TOPLEY (*Jour. Hyg. [London], 21 (1923), No. 3, pp. 226–236, figs. 2*).—This and the two following papers report some of the details of an extended investigation of epidemics among laboratory animals, the investigation resembling in many particulars a similar study at the Rockefeller Institute which has been reported by Flexner and associates (E. S. R., 48, p. 82). The first of the present series of papers compares the general results obtained in these two investigations. It is stated at the outset that the results obtained are so concordant that the main facts are nowhere in dispute, and that where differences occur they are mainly concerned with the relative emphasis laid on the various factors involved.

The remainder of the paper is devoted to a discussion of the technique employed in the present study. This differed from that employed in the work at the Rockefeller Institute in that opportunity for infection from cage to cage was prevented by the use of special cages which could be fitted together in pairs, enabling the transfer of the animals from one cage to another without any handling.

The spread of bacterial infection; group-to-group infection, W. W. C. TOPLEY and G. S. WILSON (*Jour. Hyg. [London], 21 (1923), No. 3, pp. 237–242, fig. 6*).—In the experiments reported in this paper the spread of bacterial infection was studied by placing susceptible mice in contact with others infected with *Bacillus enteritidis* (Aertrycke) and, after a definite period, re-

moving them from the infective animals and placing them with another group of normal mice. This process was repeated until the number of groups exposed in some cases reached 12. In this way the spread of infection was limited to that occurring between any one group and the one immediately following it.

It was found that under these circumstances the infection spread much less rapidly than in other experiments in which the infection could be spread in any direction among all the individuals at risk.

The spread of bacterial infection.—The problem of herd immunity, W. W. C. Topley and G. S. Wilson (*Jour. Hyg. [London], 21 (1923), No. 3, pp. 243–249, figs. 9*).—The two series of experiments reported in this paper were undertaken to determine the spread of enteric infection among mice when the immunity of the population was varied by including among the susceptible mice a varying proportion of artificially-immunized animals. In both series a certain number of mice were immunized against a strain of *Bacillus enteritidis*.

In the first series, 90 immunized and 90 normal mice were placed in cages as follows: Two cages contained 30 normal mice each and two 30 immunized mice each, and two other cages 20 normal and 10 immunized mice, respectively. All of the mice were fed at the same time with bread soaked in a 24-hour broth culture of *B. enteritidis*, the feeding being repeated on the following day and again on the fourth day of the experiment. After 60 days the cages containing only normal mice showed a total mortality of 96.7 per cent which was almost entirely specific, while the two cages containing only immunized mice had a total mortality of 63.3 and 50 and a specific mortality of 36.7 and 33.3 per cent, respectively. The cage containing normal and immunized mice in the proportion of 2:1 showed a total mortality of 56.7, and the one containing normal and immunized mice in the proportion of 1:2 a total mortality of 66.7 per cent, both being specific.

In the second experiment the cages were arranged to contain, respectively, 30 normal, 20 normal and 10 immunized, 15 normal and 15 immunized, 10 normal and 20 immunized, and 30 immunized mice. These were exposed to infection by adding to each cage on the first day of the experiment 2 infective mice and on each of the succeeding 14 days transferring the infective mice to the next succeeding cage. Each cage was thus visited three times by each pair of the infective mice. Observations were made during 120 days. Among the 30 normal mice there was a mortality of 96.7 with a specific mortality of 70 per cent, while among the immunized mice there was a total mortality of 60 per cent but no specific mortality. In the cages containing normal immunized mice in the proportions of 2:1 and 1:2 there was no spread of infection. In the cage containing an equal number of normal and immuized animals there was a total mortality of 100 per cent, with a specific mortality of 66.7 for the normal and only 40 per cent for the immunized mice.

It is concluded that, while the experiments are too few to permit definite conclusions, it appears that active immunization of mice confers a definite degree of protection against subsequent infection by feeding or from animal to animal. "There is some evidence that spread of infection occurs with difficulty among a population, each individual of which has been actively immunized. There is definite evidence that, among a population containing susceptible and immunized individuals, the relative immunity of the latter does not save them from infection and death, when epidemic spread occurs. It appears that a degree of immunity, which may save individual hosts when living among equally resistant companions, is rendered of no avail when they are surrounded by highly susceptible individuals of their own species."

The agglutination reaction for infectious abortion, A. BROERMAN (*Vet. Alumni Quart. [Ohio State Univ.], 11 (1923), No. 1, pp. 1–7, fig. 1*).—This is a general discussion of the technique of the agglutination test for diagnosing infectious abortion and of the significance of positive and negative reactions.

Botulinus antitoxin (*Kentucky Sta. Rpt. 1922, pt. 1, pp. 52, 53*).—It is noted briefly that cases of botulism have occurred in the State during the past year in horses, mules, cattle, swine, sheep, and poultry. The majority of cases among the large animals occurred after feeding corn, corn stover, or oat hay, and among the small after feeding spoiled canned goods.

An investigation of a number of flocks of sheep in which there had been many losses, particularly among the pregnant ewes, from a disease closely resembling botulism brought to light the fact that in every flock the sheep affected had been taken off pasture and placed on dry feed preparatory to lambing. Negative results were obtained in the bacteriological examination of the organs and blood of the dead animals and in the inoculation of healthy animals with the blood. The inoculation with botulinus antitoxin of sheep in various stages of the disease is said to have proved beneficial in most cases, and the inoculation of healthy animals is considered to have protected them from contracting the disease. "After making a careful study of the conditions it seemed that the toxin must have been formed outside the body in the feed or soil and was taken in with the feed, though this was not definitely determined."

[Studies of the so-called ranilla disease in Porto Rico], J. BAGUÉ (*Porto Rico Dept. Agr. and Labor Sta. Ann. Rpt., 1922, pp. 59, 60; also in Spanish ed., pp. 64, 65*).—This is a brief statement of preliminary work, consisting of a survey of the zones affected by this disease of cattle, which occurs on the southern coast, over the areas between the towns of Cabo Rojo and Ponce, and sporadic cases have appeared in Ciales and Fajardo. The opinion among farmers is that it is caused by a plant, a species of Zamia, known as "marunguey."

[Roup and chicken pox vaccine] (*Kentucky Sta. Rpt. 1922, pt. 1, pp. 51, 52*).—A combination method for the preparation of roup and chicken pox vaccine has been developed as follows: The vaccine prepared from the scabs collected from the comb and wattles and the exudate from the eyes, nose, and throat is dried, pulverized, and mixed with normal salt solution in the proportion of 1 gm. of the dried vaccine to 100 cc. of the salt solution. To this is added 100 cc. of the bacterial vaccine, the whole being sufficient to vaccinate 200 birds. The combined vaccine is said to be much more effective than the bacterial vaccine and as effective as the vaccine prepared from the scabs.

Roup in poultry, J. E. GUBERLET (*Oklahoma Sta. Circ. 51 [1923], pp. 3*).—A brief popular account.

RURAL ENGINEERING.

Annual report of the agricultural engineer [Department of Agriculture, Burma] for the year ending June, 1921, MAUNG BA GYAW (*Burma Dept. Agr., Ann. Rpts. Agr. Stas. [etc.], 1921, pp. 66–71*).—This report includes, among other things, data from experience on wind-mill pumping, turf-dike fencing, pise-de-terre construction, construction of implement buildings, and trials of animal power sugar cane crushers.

Revenue report of the Government of Bihar and Orissa Public Works Department, Irrigation Branch, for the year 1921–1922 (*Bihar and Orissa, Irrig. Branch, Rev. Rpt. 1921–22, pp. II+[131], pls. 4*).—This report

covers the activities, expenditures, and revenues from irrigation works in Bihar and Orissa in India for the year 1921–22.

The industrial utility of public water supplies in the United States, W. D. COLLINS (*U. S. Geol. Survey, Water-Supply Paper 496 (1923), pp. IV+59, pl. 1, fig. 1*).—This report describes the public water supplies of 307 cities in the United States, furnishing water for nearly 39,000,000 persons, with particular reference to their industrial uses.

In practically all the waters for which analyses are given the only constituents of much industrial consequence are calcium and magnesium. It is shown that more than 17,000,000 persons are served with water of less than 55 parts per million of such hardness, nearly 6,000,000 with water of from 55 to 100 parts per million of hardness, more than 11,000,000 with water of from 100 to 200 parts per million of hardness, and about 4,500,000 with water of more than 200 parts per million of hardness. It is stated that municipal treatment of the water of a public supply generally improves it for industrial use, but that further softening of municipally softened water is profitable for most industrial plants.

Geology and ground-water resources of Sacramento Valley, Calif., K. BRYAN (*U. S. Geol. Survey, Water-Supply Paper 495 (1923), pp. XI+285, pls. 19, figs. 10*).—This report, prepared in cooperation with the Department of Engineering of the State of California, describes the geology and water resources of the Sacramento Valley, Calif., with particular reference to the use of the water supplies for irrigation and industrial purposes.

Surface waters of Wyoming and their utilization, R. FOLLANSBEE (*U. S. Geol. Survey, Water-Supply Paper 469 (1923), pp. X+331, pl. 1*).—This report, prepared in cooperation with the State of Wyoming, presents the available data pertaining to the present and future utilization of the surface waters of Wyoming, and includes records of run-offs and information relating to irrigation, water power, and storage.

Investigation of the autopurification of water in large reservoirs exposed to the direct rays of the sun, P. C. FLU (*Meded. Burgerl. Geneesk. Dienst Nederland. Indië, No. 3, (1921), pp. 298–315*).—Experiments on the self-purification of water exposed to the sun and artificially infected with cholera organisms are reported. These indicated that river water which had been kept in a reservior for one week showed an important reduction in the number of bacteria per cubic centimeter. In a few cases the reduction was so great that the number per cubic centimeter fell below 100. Pathogenic bacteria, including cholera, dysentery, and typhoid bacteria, in this water disappeared, the cholera and dysentery after a few days and the typhoid bacteria after a week. This purifying action is attributed chiefly to the influence of protozoa. The flagellates especially are said to multiply in the water and destroy the pathogenic bacteria. There was no purifying action in water treated with materials such as potassium cyanid, which killed the protozoa. The autopurification was more rapid and complete at temperatures of from 29 to 30° C. than at the mean temperature of temperate climates of 15° (59° F.).

The design of earth dams, J. D. JUSTIN (*Amer. Soc. Civ. Engin. Proc., 49 (1923), No. 5, pp. 856–916, figs. 24*).—The object of this paper is to aid in establishing more scientific methods of designing earth dams. In this connection six criteria for the design of such dams are presented which are practically axiomatic, and the theory of design is analyzed under each of the six criteria. The laws of the flow of water through soils, sand, and gravel are discussed, and their applications to the problems of design of earth dams are explained. Approximate methods of determining the position of the line of saturation in the cross-section of an earth dam in advance of construction are

derived, and methods of computing the approximate seepage that will take place through and under earth dams under certain conditions are discussed and illustrative examples given.

Methods for determining the necessary thickness of a given material for safety against blow-outs or piping are also considered.

Considerations in design of open ditches, G. A. M'CUBBIN (*Engin. and Contract., Water Works, 59 (1923), No. 5, pp. 1077–1082, figs. 3*).—The principal features to be considered in the design of open drainage ditches are outlined in this paper. Graphic data showing hydraulic radii, mean velocity of flow, and capacities in acre inches per 24 hours for trapezoidal channels with 1:1 side slope are included, together with other tabular data.

Drainage and improvement of white land and similar wet land, W. L. POWERS (*Oregon Sta. Circ. 47 (1923), pp. 8, figs. 2*).—Practical information on drainage and improvement by proper cropping, fertilization and cultivation of white land (Dayton silty clay loam) and similar wet land in Oregon is presented.

The Vittoria Canal for the irrigation of soils on the Piave River in the Province of Trevisco [Italy], AGER (*Italia Agr., 59 (1922), No. 4, pp. 97–126, pl. 1, figs. 10*).—This is a detailed description of an irrigation project on the Piave River in Italy, covering an area of over 80,000 acres which are irrigated from primary and secondary canals in three distinct zones. Structural features and the procedure in financing are also briefly described.

Report of road materials project, I, O. V. ADAMS (*Colorado Sta. Bul. 284 (1923), pp. 3–46*).—This bulletin contains tabular data on samples of road materials of Colorado, grouped under the counties in which they are located, and data pertaining to the suitability of material for use in cement concrete and in various types of surfacing such as water-bound macadam, gravel, or sand-clay. Descriptions of a standard method of testing for organic impurities in sands for concrete and of a method suggested for the determination by volume of the percentage of silt in fine aggregate are appended.

Estimation of the constituents of Portland cement concrete, G. W. BURKE (*Iowa Engin. Expt. Sta. Bul. 61 (1923), pp. 16, figs. 2*).—The results of studies are presented, the object of which was to devise a method by which the amount of the various materials used in concrete can be determined without having samples of the original materials at hand.

It was found that for great accuracy it is necessary to have samples of the original materials. Where these are not available the silica and calcium oxid contents of the cement must be chosen for average values of the commercial product, this being considered a reliable procedure. The presence of a large amount of finely divided clay, silt, or vegetable matter in the sand will have a tendency to vitiate the results if based on the silica method alone. This, however, is not so true of the calcium-oxid-basis method, as poor sand does not seem to affect the results.

The dehydration method was found to serve as an accurate means for determining the weight of original materials, and to make possible an accurate separation of stone and of a sample of sand for analysis.

The silica content of sand-cement mixtures of samples of similar mix was not so uniform as the calcium oxid content. It is considered probable that either method may be used satisfactorily on samples made from a good grade of sand, but that for samples containing a poor grade of sand the calcium-oxid-basis method will give the more reliable results.

Cement in 1921, B. W. BAGLEY (*U. S. Geol. Survey, Min. Resources U. S., 1921, pt. 2, pp. 215–228*).—Information on the production, domestic consumption, manufacture, and foreign trade in Portland cement during 1921 is presented in

this publication. It is stated that both the total production and total shipments of Portland cement in the United States in 1921 showed a decrease of 1 per cent. The gross value of the shipments showed a decrease of 7 per cent, and the average selling price at the mills decreased about 6 per cent. Of the 27 States in which Portland cement was manufactured in 1921, 14 showed an increase in shipments and 13 a decrease as compared with the previous year. The apparent domestic consumption in 1921 showed an increase of slightly more than 0.6 per cent as compared with the consumption of 1920.

Electricity in agriculture, A. H. ALLEN (*London and New York: Isaac Pitman & Sons, Ltd., 1922, pp. X+117, figs. 35*).—This handbook, written from the English viewpoint, deals with the uses of electricity in arable, pasture, dairy, and poultry farming; horticulture; pumping and irrigation; electroculture; and general mechanical and domestic service on farms. It contains chapters on electricity supply, the distribution of electricity, domestic applications of electricity, electric driving in mechanical operations, electric plowing, electric haulage, and the Hereford development.

The electric range handbook (*New York: Soc. Elect. Development, Inc., 1921, 4. ed., pp. 222, figs. 41*).—This handbook is said to be a complete compilation of authentic information and data on electric ranges.

Farm engines and how to run them, J. H. STEPHENSON (*Chicago: Frederick J. Drake & Co., 1923, pp. 255, figs. 75*).—This is a simple practical handbook describing every part of an engine and boiler, with full directions for the safe and economical management of both. It includes also several hundred questions and answers often given in examinations for an engineer's license and chapters on farm engine economy and water-supply systems in the farm home. Numerous illustrations showing the different parts of a boiler and engine and a number of makes of traction engine, with brief descriptions of the distinctive points in each make, are included.

Some uses of ball and roller bearings on agricultural machines (*Génie Rural, 16 (1923), No. 128, pp. 25–28, figs. 16*).—The more common uses of ball and roller bearings on tractors and other farm machines are briefly described and diagrammatically illustrated.

The whirling of an overhung eccentrically loaded shaft, S. LEES (*Phil. Mag. and Jour. Sci., 6. ser., 45 (1923), No. 268, pp. 698–708, figs. 3*).—In this paper an effort has been made to indicate the kinematics of the motion of the free end of an overhung eccentrically loaded shaft, assuming neglible torsional effects. The general equations of motion are then deduced for an eccentrically loaded disk or fly-wheel, leading to the conclusion that whirling may be regarded as due to the amplitude of the steady, forced oscillation of the free end of the axis around the constrained axis, becoming theoretically infinite at a certain speed. Alternatively whirling even for a symmetrically mounted fly-wheel is regarded as having a similar origin on account of slight deviations of the center line of the shaft from the straight line initially.

An effort is made to show that elastic viscosity in the shaft itself can not prevent whirling in the slightest degree, but that external friction may enable the system to pass safely through what would be a whirling speed without such friction.

The effect of elastic yielding at the bearing was also investigated both for symmetrical and unsymmetrical elasticity. The curious result was obtained that for unsymmetrical elasticity or elliptic motion there are three whirling speeds, neglecting friction. Apart from whirling, there is no question of instability. The two extra whirling speeds are traced down to an effect

which vanishes when the motion becomes circular. It is considered possible that external friction may mask these additional speeds of whirling.

Specifications for leather belting (*Philadelphia: Leather Belting Exch., 1922, pp. 11, fig. 1*).—Specifications for use as the basis of purchase for miscellaneous sizes, single and double ply, of first quality vegetable tanned leather belting for general use and waterproof-dressed and waterproof leather belting are presented. These were prepared by the U. S. Bureau of Standards and the Leather Belting Exchange.

Coal tar as a source of fuel for internal-combustion engines, W. J. Huff (*Chem. Age [New York], 31 (1923), No. 4, pp. 147–150*).—A considerable amount of data from various sources is summarized on the possibility of using coal tar as a source of fuel for internal-combustion engines.

Motor spirits and ethylite, L. J. Lavedan (*La. Planter, 70 (1923), No. 18, p. 348*).—The results of experience with different alcohol fuels for internal-combustion engines are briefly summarized, and attention is especially drawn to ethylite, which is a mixture of a very large percentage of alcohol, a small amount of ether, an essence, and an alkaline base. It is claimed that ethylite gives 30 per cent more power than any other hydrocarbon fuel, does not produce carbon, does not give violent explosions, and does not cause overheating.

Utilization of vegetable oils for motive power, Mathot (*Bul. Matières Grasses, Inst. Colon. Marseille, No. 7–8 (1921), pp. 116–124*).—Tests of four 2-stroke cycle and one 4-stroke cycle engine using palm and cottonseed oils for fuel are reported and discussed.

The results are taken to indicate that semi-Diesel motors of either the 2 or 4-stroke cycle type may be accommodated perfectly with vegetable oils as fuel. Such fuels are considered to be practical and economical sources of power for colonial requirements in the Tropics.

Tests of tractor on palm oil, P. Gasthuys (*Bul. Matières Grasses, Inst. Colon. Marseille, No. 2 (1923), pp. 49–63*).—The results of laboratory tests of a tractor engine and field tests of the tractor on plowing and hauling, using crude petroleum and palm oils as fuel, are reported, the purpose being to show that palm oil may be effectively and economically used as a tractor engine fuel in the Tropics.

Tractors in Arkansas, D. G. Carter (*Arkansas Sta. Bul. 186 (1923), pp. 18, figs. 7*).—This bulletin summarizes the answers of 100 tractor owners in Arkansas to a questionnaire relating to their tractor experience and the results of a certain amount of personal observation on the use of these tractors. In addition, a brief discussion is given on the use of tractors in the rice and fruit sections, together with an analysis of tractor failures. It is noted that the tractor sizes used ranged from 8–16 to above 15–30 in size. Both kerosene and gasoline were used for fuels.

A wide variation was noted in repair costs, amount of time used, number of acres plowed per day, and in other important factors. This is considered to emphasize the fact that the selection of a tractor that will be profitable is a special problem depending upon the size of farm, kind of crops, size of fields, and other factors.

Cotton-dusting machinery, E. Johnson, S. T. Howard, and B. R. Coad (*U. S. Dept. Agr., Farmers' Bul. 1319 (1923), pp. [2]+20, figs. 4*).—This bulletin supersedes Farmers' Bulletin 1098 (E. S. R., 42, p. 786), and presents practical information to the prospective buyer of cotton dusting machinery on how to select a type of dusting machine suited to the conditions and needs of his own farm.

Grounding cotton gins to prevent fires, H. E. Roethe (*U. S. Dept. Agr. Dept. Circ. 271 (1923), pp. 4, fig. 1*).—Practical information on the grounding

of cotton gins to prevent fires resulting from the generation of static electricity in moving parts is briefly presented.

Ventilation, C.-E. A. WINSLOW ET AL. (*New York: E. P. Dutton & Co., 1923, pp. XXVI+620, figs. 134*).—This is a report of the New York State Commission on Ventilation.

Effect of pressure on hot water circulation, F. B. ROWLEY (*Jour. Amer. Soc. Heating and Ventilating Engin., 29 (1923), No. 3, pp. 271–274, figs. 4*).—The results of studies conducted at the University of Minnesota on a small gravity hot water heating system to determine the effect of pressure on hot water circulation are reported.

In general, it was found that the effect of pressure on circulation is very slight, any difference being in favor of the pressure system—that is, a pressure at least equal to that of the open-tank system. The test results indicated that, while the water circulation was nearly the same at all pressures from 0 to 30 lbs. gauge, it was slightly less at zero pressure. The temperature drop between the riser and return lines was also slightly greater at zero pressure, indicating a slight decrease in circulation if the pressure is reduced below that of the open-tank system. At 15 and 30 lbs. gauge pressures the circulation and temperature drops were practically the same, indicating no advantage in increasing the pressure over that of an open-tank system.

Tests to determine the effect on circulation of pressure variation during operation showed that the change in pressure disturbed the system, and in general the circulation was somewhat increased by lowering the pressure and decreased by raising it. The decrease was attributed to the admission of cold water to raise the pressure, since as soon as the boiler recovered its normal temperature, the circulation returned to normal.

Insulation of cold surfaces to prevent sweating, L. L. BARRETT (*Jour. Amer. Soc. Heating and Ventilating Engin., 29 (1923), No. 3, pp. 263–270, figs. 4*).—The object of this paper is to establish a mathematical basis for determining the thickness of insulation required to prevent sweating on the surface thereof under various conditions of temperature and humidity, and to present curves of data from tests, which will obviate the necessity of any mathematical work in making such practical determinations.

[Sewage disposal studies at the Indiana Station] (*Indiana Sta. Rpt. 1922, p. 44, fig. 1*).—A detailed drawing of a homemade automatic siphon for use in small sewage disposal systems, which was designed at the station, is presented and briefly discussed.

Investigations of the duration of life of cholera vibriones and typhoid bacteria in septic tanks at Batavia, P. C. FLU (*Meded. Burgerl. Geneesk. Dienst Nederland. Indië, No. 3 (1921), pp. 288–297*).—Experiments conducted with several small-sized septic tanks to determine the duration of life of cholera and typhoid organisms artificially introduced into the tanks are reported. It was found that even under the favorable conditions due to high temperature the pathogenic organisms always appeared in the effluent from the infected tanks within a few hours after infection. It is concluded that the organisms which are suspended in the water are quickly carried away in the current that exists in the contents of the tank.

RURAL ECONOMICS AND SOCIOLOGY.

The objectives in agricultural cost accounting, H. C. TAYLOR (*Jour. Farm Econ., 5 (1923), No. 2, pp. 65–78*).—It is held that accurate cost data properly interpreted should greatly increase the accuracy of the judgment of the farmer with reference to a choice between two or more lines of production on the basis

of relative profitableness, the selection of the more profitable among competing crops, and the introduction of the best noncompeting crop. Another aim of agricultural accounting is said to be to furnish a basis of choice between two or more methods of carrying out a given line of production, especially in the matter of the degree of intensity, as well as of the choice of equipment and the most profitable method of disposing of the product.

Distribution of types of farming in the United States, W. J. SPILLMAN (*U. S. Dept. Agr., Farmers' Bul. 1289 (1923), pp. II+30, figs. 5*).—The principal agricultural regions here considered are designated as New England, New York, the Cotton Belt, Mountain and Pacific Coast States, the Plains States, and the Corn Belt. The distribution of the major crops of cotton, corn, wheat, oats, and hay, as well as of fruits and vegetables and livestock, is described for each, and in some instances it is attempted to forecast changes in the systems of farming. Certain phases of the subject are graphically illustrated.

[Report of the Indiana Station] department of farm management (*Indiana Sta. Rpt. 1922, pp. 31–34, figs. 3*).—Brief notes and data are given with reference to investigations carried on at the station during 1922, covering farm organization and power and the cost of production of beef, wheat, oats, and hogs.

Farm management study in the Purchase Region of western Kentucky (*Kentucky Sta. Rpt. 1922, pt. 1, pp. 19, 20*).—A complete business analysis was made of 115 farms in Calloway, Marshall, McCracken, Graves, Ballard, and Carlisle Counties for the year 1921.

The net earnings of the operators averaged —$113, although the 10 most profitable farms made average earnings of $841. It is indicated that on these the labor and teams were handled with maximum efficiency, crops were limited to an acreage that could be cultivated well at a moderate cash outlay, the tobacco produced was of high quality, and a greater proportion of these farms was in grass and more livestock was kept than on the average farm in the section.

Farm management, 1920.—III, Mixed farming and apple growing in Ontario, H. W. CLARKE and A. LEITCH (*Ontario Dept. Agr. Bul. 282 (1921), pp. 23*).—Continuing the series previously noted (E. S. R., 44, p. 190), this is a report on a survey of 200 farms in Durham County, Ontario, for the year ended April 30, 1920. Of these farms, 35 were practically straight commercial orchard enterprises, and the remainder were mixed farms on practically all of which the orchard was the important enterprise. Tabulations, with interpretation, are given, setting forth the influence of size of farm on labor income, the financial condition of both orchard and mixed farms, the effect of good livestock on the labor income, dairying as a supplementary industry, and the cost of production of apples.

Farm management, 1920.—IV, The fruit growing business in Niagara district, E. E. REILLY (*Ontario Dept. Agr. Bul. 286 (1921), pp. 1–19, figs. 2*).—This is a report of some of the findings and conclusions derived from a study of the business of 178 fruit farms in the Niagara district of Ontario for the year ended December 31, 1920.

The farms visited ranged in size from 2 to 240 acres, about 60 per cent being between 10 and 50 acres in area. Almost without exception 90 per cent or more of the farm income was obtained from fruit and vegetable sales.

The data are tabulated to indicate the sizes of farms and labor incomes, investment in land and equipment, sources of revenue, receipts from specialized crops and in particular sections, and years of ownership as affecting labor income.

Farm management, 1920–21, V (*Ontario Dept. Agr. Bul. 288 (1922), pp. 31*).—Two farm surveys are reported upon in these pages.

Mixed farming in the Ontario corn belt, H. W. Clarke (pp. 7–15).—Records were obtained from 234 farms within a 15-mile radius of the city of Chatham and in the district south and east of Blenheim in Ontario.

The average size of farm was 117.7 acres, the average number of acres in crops per farm 78.1, the average capital invested $21,662, and the average real estate value per farm $16,974, and per acre $144.

Tables are presented showing the organization of farms of various sizes, labor income, and the influence of crops and livestock on labor income.

It is indicated that the Kent County farmer operating, as he does, high-priced land can not neglect to grow the special cash crops of sugar beets, tobacco, and beans.

Mixed farming and apple growing in Ontario, G. W. Michael (pp. 17–31).—This is a second survey of the apple-growing districts of Durham and Northumberland Counties, Ontario, for the year ended April 30, 1921. An analysis is made of the business on 261 farms as compared with 200 farms which serve as the basis of the earlier report noted above.

The 1920 crop year shows a spread of $992 in labor income on the two types of farm. There is a difference of $1,599 for the mixed group and of $675 for the orchard farmers in this and in the previous crop year. The orchard farmers profited to a greater extent than mixed farmers, and there is shown to be an ample opportunity for specialization in the business. On the 46 specialized orchard farms there was produced an average of 41 barrels of apples per acre, which sold for an average of $4.02 per barrel, a net loss of 83 cts.

Poultry farm survey.—A report on 65 commercial poultry farms in the Lower Fraser Valley and Vancouver Island for the year ending December 31, 1921, E. A. Lloyd et al. (*Brit. Columbia Dept. Agr., Dept. Circ. 41 [1922], pp. 19, fig. 1*).—In this survey the average area of the farms was 13.6 acres. The estimated average value of land and buildings was $443.84 per acre, 52 per cent of which was in buildings and 48 per cent in land. The poultryman's dwelling represents an average value of $1,500, or 25 per cent of the total investment in land and buildings.

The investment in the different farms according to capital ranges from $2,844.80 to $16,289.48. The average return on investment amounted to 13 per cent. All of the groups of farms yielded on the average a plus labor income. Farms of the group carrying an average investment of $4,967.69 returned the highest interest on investment and also the highest labor income, viz., $671.75. This net labor income corresponds to the farm income of $1,019.53, or 20.5 per cent return on investment. The highest farm income was derived from those farms with an average total investment of $11,038.44. After deducting interest an average labor income of $617.05 was obtained.

On the large farms it cost $152.37 in man labor for 100 birds. The cost of man labor per 100 birds increased as the size of the flock decreased until it cost $755.91 in man labor per 100 birds in the case of flocks of 200 birds or less.

The highest labor incomes were obtained from flocks which consisted of from 61 per cent to 80 per cent of pullets, while the highest labor income per bird was made from the flocks that carried a still higher percentage of pullets.

The majority of the poultry farms and the best paying ones were from 5 to 15 acres in size. As farms increased beyond 15 acres the labor income rapidly decreased.

The average selling price per dozen eggs on 29 farms was 39.4 cts., and the average estimated cost of production, including interest on investment at 7 per cent and operator's wages at $80 per month, was 45.6 cts. Without allowing operator's wages the cost of production was 32 cts. per dozen.

Farm mortgage financing, I. WRIGHT (*New York and London: McGraw-Hill Book Co., Inc., 1923, pp. IX+343, figs. 2*).—These chapters are essentially the elementary conclusions of studies based upon the development of the farm mortgage situation in the United States from free land to the present vast mortgage indebtedness in three quarters of a century, the needs of American farmers for farm mortgage credits, the origin and development of farm mortgage banking, banking systems and agencies in the United States handling farm mortgage credits and their methods of operation, legal and financial aspects of farm mortgages, investors in farm mortgages, marketing of farm mortgage securities, taxation of mortgage credits, vaulation of agricultural lands by different agencies and for different purposes, and the factors affecting the prices of agricultural lands. The appendixes contain an account of the registration of land titles in the United States and the legal and economic problems involved, miscellaneous State land banking schemes, the use of public funds by States for financing agriculture, and an account of some aspects of the farm mortgage history of the United States.

Weather, Crops, and Markets (*U. S. Dept. Agr., Weather, Crops, and Markets, 3 (1923), Nos. 22, pp. 529–552, figs. 2; 23, pp. 553–576, figs. 5; 24, pp. 577–608, figs. 2; 25, pp. 609–632, figs. 2; 26, pp. 633–656, figs. 3*).—Temperature and precipitation charts for the weeks ended May 29 and June 5, 12, 19, and 26, 1923, are presented in these numbers, with general and weekly summaries of weather conditions. There appear also the usual weekly and monthly reports, summaries, and special articles covering the receipts and prices of important classes of crops and livestock and the position in the market of specific commodities. Miscellaneous brief crop reports are contained in Nos. 22, 23, and 26. No. 24 contains the United States crop summary for June; tabulations of crop conditions, June 1, 1923, with comparisons; the usual farm price reports; and short special articles, including one on the trend of farm prices.

The art of forecasting wheat prices by the use of harmonic cycles, L. H. WESTON (*Washington, D. C.: Author, 1923, pp. 28, figs. 11*).—The recorded mean prices of wheat in England yearly between 1270 and 1909 are given in a table and a diagram, as are also monthly mean prices of wheat at Chicago and Cincinnati from 1844 to 1921. Special charts are also given to illustrate the explanations regarding the method of forecasting by means of cycles. Forecasts are made over 40 years and charted.

Socialism and French agriculture, M. LAIR (*Le Socialisme et l'Agriculture Francaise. Paris: Plon-Nourrit & Co., 1922, pp. 97*).—This paper gives a résumé of the efforts of the socialist party to reach the agricultural classes in France, especially the peasant small holders. Three periods in its activity are distinguished, the first dominated by the theories of Marx, Kautsky, and Liebknecht and characterized by grouping attempts to formulate an agrarian socialism that would appeal to the rural element, the second beginning with the twentieth century and marked by better organized efforts to arouse discontent and enlist rural support. Landowners were in the majority, however, and statistics are cited which show that their ranks were being steadily increased from among the farm workers, none of whom migrated from the rural districts while they entertained the slightest hope of acquiring land. The number of medium-sized holdings remained stationary, while the large farms scarcely maintained their own numbers. The third period is that beginning

with the end of the World War when efforts were redoubled and an appeal was made to the international proletariat and the League of Nations.

Attempts of the International Labor Office to organize agricultural workers are noted. It is deemed impracticable, however, to adapt to the agriculture of all regions alike a set of regulations with international application.

War and agriculture, SAGAWE (*Arb. Deut. Landw. Gesell., No. 316 (1922), pp. 22*).—This paper sets forth statistically the effects of the war upon 112 large farms in central and eastern Germany, the data being obtained from bookkeepers' records covering the period 1911–12 to 1919–20, inclusive. Farms are grouped according to soil classes and location. The prices received for crops and livestock and prices paid for fertilizers and feeds are tabulated in marks and in percentages on the basis of the 1912–1914 price. Changes are pointed out in the proportions of crops grown, numbers of livestock, crop yields, returns from livestock, gross and net income, and porperty values.

Northern Africa: Its agricultural and economic future, H. COSNIER (*L'Afrique du Nord: Son Avenir Agricole et Économique. Paris: Emile Larose, 1922. pp. LI+356, pls. 11*).—This is a companion volume to an earlier one (E. S. R., 47, p. 694), reporting upon the investigations of a mission sent out in April, 1917, by the French minister of commerce.

Agricultural conditions in Morocco (*Jour. Roy. Soc. Arts, 70 (1922), No. 3640, pp. 698–702*).—This is a description of the region and its staple crops, which are barley, wheat, corn, sorghum, oats, canary seed, and millet, together with various regional crops. Customs of landholding and the organization and development of agriculture are briefly noted.

Nebraska farm homes.—A comparison of some living conditions of owners, part owners, and tenants, J. O. RANKIN (*Nebraska Sta. Bul. 191 (1923), pp. 48, figs. 20*).—Additional data gathered from a survey of about 1,140 farms in Nebraska previously noted (E. S. R., 49, p. 189) are the basis of this discussion, comparing the farms of owners, part owners, and tenants in the matters of housing; drainage, windbreaks, sites, and views; gardens and fruits; farm buildings and water supply; power and lighting; and modern water, heating, and lighting systems.

It appears that the value per house varies greatly from section to section but averages $1,800–$2,400 among owners, $2,200 among part owners, and $1,400 among tenants. Owners' and part-owners' houses average 7 rooms, tenants' houses 6 rooms. Little or no overcrowding of houses, rooms, or grounds is found, three bedrooms per house or 1 for each person and a half being usual. Screens cover nearly all the doors and windows, half of the back porches, and about a sixth of the front porches. Tenants' yards are oftener without grass, trees, flowers, and shrubs, but three-fifths of all houses have windbreaks. Fruit trees and home gardens are found on almost all farms, but only two-fifths of the owners and part owners and a quarter of the tenants have small fruits. Most homes are still without power or lighting systems. Two per cent of all farm houses are fully modern, that is, have modern water, lighting, and heating systems, and about 12 per cent are modern in one or more of these respects. The percentages are increasing rapidly. Owners have modern homes in about three times as great percentages of cases as do tenants.

The country newspaper, M. V. ATWOOD (*Chicago: A. C. McClurg & Co., 1923, pp. [8]+137*).—This volume is an attempt to show the importance of the country weekly to the life of the small town and rural community, describing how it is made and financed, its value to the community, and its problems and difficulties. The author takes the view that as it becomes a better paper it will give greater service to its community and fill an urgent need. A brief

bibliography is given listing books and magazine articles relating to the small town newspaper.

AGRICULTURAL EDUCATION.

Proceedings of the thirty-sixth annual convention of the Association of Land-Grant Colleges (*Assoc. Land-Grant Cols. Proc., 36 (1922), pp. 376, figs. 12*).—Lists of officers, delegates, and colleges taking part in the convention at Washington, D. C., November 21–23, 1922, discussed editorially (E. S. R., 47, p. 701; 48, p. 1); the constitution of the association as amended November 22, 1922; committee reports; and minutes of sessions are embodied in this volume, together with the address of H. C. Wallace, Secretary of Agriculture; a selected list of references on the preparation and use of illustrations, prepared by M. L. Gericke, R. Brigham, and C. H. Hanson; and the following addresses and papers: Tendencies and Problems in Land-grant Institutions, by A. A. Potter; address of the president of the American Farm Bureau Federation, by J. R. Howard; Agricultural Economics in Europe, by G. F. Warren; Organization of Agricultural Education and Research in Czechoslovakia, by J. G. Lipman; The Work of the International Institute of Agriculture in Relation to Agricultural Education and Research, by W. H. Stevenson; Agricultural Education and Research in China and Japan, by K. L. Butterfield; After Fifty Years, by W. H. Jordan; The Wheat Situation in the Northern Great Plains Area, by C. R. Ball; Status of Engineering Experiment Stations at Land-grant Colleges, by L. D. Crain; How Shall the College of Agriculture Determine the Aims and the Organization of Its Courses of Study? by A. R. Mann; Aims, Purposes, and Credit Values of Laboratory Work, by R. L. Watts; Some Aspects of the World Agriculture Situation and European Consumption, by E. G. Montgomery; The Application of Probable Error to Agricultural Experimentation, by H. H. Love; Relation of the Experiment Station to Graduate Work of the College, by E. W. Allen; The Future of Agricultural Experiment Stations, by W. H. Jordan; The Environment of the Research Worker, A Human Problem in Station Administration, by S. B. Haskell; The Problem of Research in a College of Agriculture, by F. B. Mumford; State and Federal Cooperation in Agricultural Research, by E. D. Ball; A Method of Measuring Extension Work, by M. S. McDowell; Use of Census and Other Statistical Data in Diagnosing a Community's Needs, by T. A. Coleman; The Training of Extension Workers, by D. J. Crosby; The Field of the Extension Specialist, by H. J. C. Umberger; The Function of Research Departments in Determining Extension Programs, by G. I. Christie; The Cost of Technical Education, by R. L. Sackett; The Improvement of Engineering Education, by C. R. Mann; The Organization of an Engineering Experiment Station, by O. M. Leland; The Ideal Five-year Engineering Course, by E. J. McCaustland; Standards for Salaries and Promotions, by H. B. Thompson; What Constitutes a Teaching Load, by M. E. Sweeny; The Relationship Between Administrative Officers and Teachers, by F. Rose; What Standard Shall We Set for a Background of Vocational Experience for College Teachers and How Shall It Be Acquired? by F. R. Lanman; How May We Improve the Teaching Methods of the College Staff? by W. W. Charters; Measuring the Success of College Teaching, by M. S. Fedde; Local Leadership in Project Work, by M. Sayles; Local Leadership in the Nutrition Project, by F. M. Thurston; Relation Between Extension Work and Research, by C. F. Langworthy; Home Economics Courses for Extension Workers, by G. E. Frysinger; The Plan for the Bureau of Home Economics, by E. D. Ball; Home Economics Research in England, by C. F. Langworthy; Research in

Home Economics, by M. L. Matthews; and The Publication of Research Findings, by H. W. Atwater.

Agricultural education, G. A. Works (*U. S. Bur. Ed. Bul. 19 (1923), pp. 21*).—This bulletin presents advanced sheets from the Biennial Survey of Education in the United States, 1920–1922. Information regarding the spread of instruction in vocational agriculture is taken from the 1922 report of the Federal Board for Vocational Education (E. S. R., 48, p. 692), and three principal types of schools and classes are described. The attitude is definitely taken that boys' and girls' club work should have an educational rather than an economic aim.

Progress is noted in the study of local farming enterprises and the development on the basis of theses studies of courses that are more likely to function in the educational careers of the students than are the more formal courses based on texts and general outlines. Three factors held to have contributed to the improvement of courses of study are the more adequate development of the home project, the use of the farm survey as a means of instruction, and the job analysis which is being developed. There has been a tendency to develop a supervisory staff on a State basis and to facilitate the training of teachers.

Portions of the report of the joint committee representing the Association of Land-Grant Colleges, the National Society for Vocational Education, the department of rural education of the National Education Association, and the American Association for the Advancement of Agricultural Teaching (E. S. R., 48, p. 394) are quoted, as are also parts of the presidential address by H. L. Russell and other reports and recommendations from the thirty-fifth annual convention of the Association of Land-Grant Colleges (E. S. R., 49, p. 491). Brief notes are given with reference to the activities of a number of bodies concerned with agricultural education.

Objectives in elementary rural school agriculture, E. E. Windes (*U. S. Bur. Ed., Rural School Leaflet 11 (1923), pp. 18*).—The author discusses the three facts of the progresssive decrease of the percentage of rural population in the total, the progressive increase of tenancy, and the progressive increase in the percentage which the amount of farm mortgages bears to the total value of farm property, and the migration from the country districts to the city, upon which the so-called rural decay hypothesis is predicated.

It is held that rural life problems grow out of overproduction and excessive competition within the farming group, and that the educational program has served to intensify these problems in part through attempting to keep a higher percentage of the country population on the farm. The objectives to be realized in a system of education which would shift the emphasis are grouped as (a) objectives concerned with vocational guidance, involving among other advantages a sampling of vocational skills in several vocations and the opportunity of a free choice of life work, (b) those concerned with the adaptation of children to their rural environment, (c) those concerned with developing an appreciation of nature, (d) those especially concerned with technical agriculture, involving the use of materials in study, the method of attack in solving agricultural problems, the essential problems involved in plant and animal farm enterprises, and the utilization and methods of disposal of farm products, (e) language objectives contributed to through agriculture, involving the essentials of the effective usage of English, and (f) other objectives concerned with the motivation of elementary school subjects.

The rural-teacher situation in the United States, M. Carney (*U. S. Bur. Ed., Rural School Leaflet 14 (1923), pp. 12*).—The status of rural teachers in

certain parts of the United States as revealed by several published studies is briefly reviewed and found to be seriously low with respect to training, experience, and salary.

In regard to what is being done to meet the situation, it is pointed out that whereas less than a half dozen normal schools and the high schools of but 5 States offered special courses for the preparation of rural teachers prior to 1908, over 50 per cent of all normal schools and 24 State high-school systems do so at the present time. The various agencies now engaged in this task are classified into two groups: The in-service agencies, or those employed for the further training of rural teachers while they are in actual teaching service, as institutes, reading circles, extension classes, correspondence courses, summer sessions, and supervision; and pre-service agencies, or those institutions which undertake to prepare prospective rural teachers prior to their term of service, as State normal schools, high schools, and county training schools, agricultural colleges, and private and denominational colleges. The State normal school or teachers' college is deemed the most proper and permanent agency for the preparation of rural teachers.

From a study by the author, which is to be published in full at a later date, it is indicated that of 172 general public normal schools in the United States in 1922–23, 52 employed special rural instructors. Sixty-one others offered special rural courses taught not by special rural instructors but by other regular members of the faculty. A third group of 25 institutions offered no regular courses, but did conduct some special rural activities, while 34 schools frankly reported that they were doing nothing whatever for rural education in any specialized sense. Less than 2 per cent of the 300,000 rural teachers of the country, however, are normal school graduates.

In order to meet the demand for rural teachers, 24 States are now providing rural-teacher training in State-aided high schools. This is held to be a practical alternative to be abandoned as soon as possible, and three precautions are emphasized, (1) that the legislation permitting high schools to enter the normal-school field should be restricted to a period of five years, after which it can be renewed or eliminated as conditions may warrant; (2) that all teacher-training work in high schools should invariably be so organized as to insure a gradual improvement of standards for teaching throughout the entire State; and (3) that it should be so articulated and adjusted to State normal schools and teachers' colleges as to promote their welfare and the best development of the whole profession of teaching. The adoption of comprehensive programs in both State and Federal units supported by generous finances is urged.

Public professional agricultural education, G. Wery (*Vie Agr. et Rurale, 21 (1922), No. 28, pp. 37–39; also in Compt. Rend. Acad. Agr. France, 8 (1922), No. 18, pp. 541–549*).—This is a résumé of the results thus far achieved in carrying out the laws of August 2, 1918, and August 5, 1920, and subsequent decrees. It describes the sections of applied agriculture for preparing professional agriculturists which have been established at the National Institute of Agronomy, the National School of Agricultural Industries, and the national schools of agriculture, and the organization of agricultural schools, continuation schools, and agricultural education for young girls.

MISCELLANEOUS.

Thirty-fifth Annual Report of Georgia Station, 1922, H. P. Stuckey (*Georgia Sta. Rpt. 1922, pp. 30, figs. 6*).—This contains the organization list, a report by the director of the station on its work during the year, and a financial statement for the fiscal year ended June 30, 1922. The experimental work reported is for the most part abstracted elsewhere in this issue.

Thirty-fifth Annual Report of Indiana Station, 1922, G. I. CHRISTIE and H. J. REED (*Indiana Sta. Rpt. 1922, pp. 68, figs. 35*).—This contains the organization list, a report of the director summarizing the activities of the station, publications of the year, changes in staff, etc., and a financial statement for the Federal funds for the fiscal year ended June 30, 1922, and for the remaining funds for the fiscal year ended September 30, 1922. The experimental work reported is for the most part abstracted elsewhere in this issue.

Thirty-fifth Annual Report of Kentucky Station, 1922, I, T. COOPER (*Kentucky Sta. Rpt. 1922, pt. 1, pp. 61*).—Part 1 of this report contains the organization list, a financial statement as to the Federal funds for the fiscal year ended June 30, 1922, a report of the director on the work of the year, and meteorological data. The experimental work reported is for the most part abstracted elsewhere in this issue.

Thirty-fifth Annual Report of Maryland Station, 1922, H. J. PATTERSON (*Maryland Sta. Rpt. 1922, pp. XVI+249, figs. 77*).—This contains the organization list; a report by the director on the work and publications of the station; a financial statement for the fiscal year ended June 30, 1922; and reprints of Bulletins 244–250, previously noted. A list of the bulletins published by the station from 1888 to 1922 is appended.

Thirty-third Annual Report of New Mexico Station, 1922, F. GARCIA (*New Mexico Sta. Rpt. 1922, pp. 52, figs. 4*).—This contains the organization list, a report of the director on the work and publications of the station, and a financial statement for the year ended June 30, 1922. The experimental work reported is for the most part abstracted elsewhere in this issue.

Biennial Report of Oregon Station, 1921–22, J. T. JARDINE (*Oregon Sta. Bien. Rpt. 1921–22, pp. 104*).—This contains the organization list and a report of the director for the biennium ended June 30, 1922, including synopses of departmental reports and notes on the substations. The experimental work not previously reported is for the most part abstracted elsewhere in this issue.

Annual Report of Porto Rico Insular Station, 1922, R. MENÉNDEZ RAMOS ET AL. (*Porto Rico Dept. Agr. and Labor Sta. Ann. Rpt., 1922, pp. 68; also Spanish ed., pp. 74*).—This contains the organization list, a report by the director for the fiscal year ended June 30, 1922, and departmental reports, the experimental features of which are for the most part abstracted elsewhere in this issue.

Thirty-fifth Annual Report of Rhode Island Station, 1922, B. L. HARTWELL (*Rhode Island Sta. Bul. 193 (1923), pp. 16*).—This report by the director includes experimental work for the most part abstracted elsewhere in this issue.

Annual Report of South Dakota Station, 1922, J. W. WILSON ET AL. (*South Dakota Sta. Rpt. 1922, pp. 32*).—This contains a report by the director on the organization, work, and publications of the station; a financial statement for the fiscal year ended June 30, 1922; and departmental reports. The experimental work recorded is for the most part abstracted elsewhere in this issue.

Bimonthly Bulletin of the Western Washington Station (*Western Washington Sta. Bimo. Bul., 11 (1923), No. 2, pp. 25–47, figs. 7*).—This number contains brief articles entitled Notes on Several Prevalent Weed Pests, by M. E. McCollam; Raising Males to Head the Breeding Flocks, by Mr. and Mrs. G. R. Shoup (see p. 576); Coccidiosis in Chickens, by W. T. Johnson; Some Common but Unfamiliar Fruit Pests, by A. Frank; Controlling Bacteria of the Dairy, by H. E. McNatt; Thinning Fruits, by H. D. Locklin; and Annual Farmers' Excursion to the Station.

NOTES.

Delaware University and Station.—C. R. Runk, assistant professor of agronomy in the university, has been added to the station staff as assistant agronomist and will give special attention to soil acidity studies.

Florida University and Station.—Recent appointments include O. C. Bryan as assistant professor of agronomy, John Gray as assistant professor of economic entomology and plant pathology, H. G. Hamilton as instructor in farm management, Charles E. Abbott as instructor in horticulture, G. H. Blackmon as pecan culturist of the station beginning September 1, Dr. L. O. Gratz as assistant plant pathologist, and Miss Virginia P. Moore as assistant State agent of demonstration work.

Mississippi Station.—George S. Templeton of the Texas College has been appointed animal husbandman vice C. J. Goodell, who has been transferred to the department of agricultural economics. Henry D. Barker, Ph. D., has been appointed plant pathologist.

New Hampshire Station.—Experiments in sheep breeding conducted for a third of a century by Dr. Alexander Graham Bell on his Nova Scotia estate are to be continued by the station under an arrangement just completed with Dr. Bell's heirs. The agreement will make it possible to combine Dr. Bell's extensive work on Cape Breton Island, continuing from 1890 almost to the time of his death, with the extensive studies in progress for the last fifteen years by the station itself.

Dr. Bell was particularly interested in developing a more prolific breed of sheep and in increasing the milk yield of the ewes so that they could suckle more lambs. It is estimated that he had expended nearly $250,000 on this work, and he had attained considerable success in developing a flock with a very high percentage of twin bearers and with from four to six functional nipples instead of two. The station has been investigating sheep breeding as an Adams Act project, crossing different breeds with a view to determining the closeness with which the characters of hybrids are fixed, in the endeavor to produce a sheep that would combine some of the best features of the wool and mutton types and would be particularly profitable under New England conditions.

Under the terms of the agreement the Bell estate will present to the station this fall five ewes and one ram, all of the four to six nipple strain, and all from either a twin or triplet progeny. The animals will be crossed with some of the station sheep, the records of which show a ewe that has produced consecutively five sets of twins and one of triplets, while fifteen additional ewes have produced from two to four twins and no singles. Since the profits in sheep raising come from the lamb crop even more than from the wool, the possibilities in this field are apparent. What has not been generally realized, however, is that the milk yield of the ewes must be developed in order that twin or triplet lambs should not have a stunted growth. This was a firm belief of Dr. Bell and has been emphatically shown by the station experiments.

Oklahoma College.—Bradford Knapp, dean of the College of Agriculture of the University of Arkansas and director of the Arkansas Station, has been appointed president and has entered upon his duties. C. T. Dowell has been appointed director of the station and acting dean of the college.

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EXPERIMENT STATION RECORD.

VOL. 49. NOVEMBER, 1923. No. 7.

The World's Dairy Congress, held from October 2 to 10, 1923, was a notable occasion from several points of view. It was the first international gathering ever assembled in the United States for the promotion of the dairy industry, and by far the most ambitious undertaking of the kind thus far attempted in this country in the interest of any phase of agriculture. It brought together for the first time on American soil since the World War an important group of the world's scientific workers, and its meetings, sponsored by the Government itself, did much to put prominently before the general public the broad relations and outstanding significance in everyday life of the dairy industry, as well as to help to revive the spirit of international cooperation and good will.

The congress was primarily the outgrowth of a demand which developed in the different countries during and after the war for a resumption of the international exchange of scientific knowledge to aid in solving new problems in the science and practice of dairying and the use of milk in the human diet. The initiative in this respect was taken by the United States, and in 1920 a temporary organization of workers in dairy science and the dairy industry was effected here, which later was incorporated as the World's Dairy Congress Association (Inc.). This body received the active cooperation of the International Dairy Federation, a continuing body with headquarters at Brussels, the National Dairy Council, the National Dairy Association, and many other dairy organizations of this country. Its official character was established by the action of Congress, which in March, 1921, requested the President to extend invitations to foreign Governments to be represented in a congress to be held in this country in 1922. This date was subsequently postponed to 1923, and an appropriation of $30,000 made for the interpretation and publication of the proceedings. The balance of the expenses was defrayed by the dairy interests of the country.

Membership in the congress was classified as including official delegates (those specifically designated as representatives of national, State, municipal, or provincial Governments and the educational or research institutions supported by Governments), delegates repre-

senting associations, and member delegates including all others. A registration estimated at 1,820 persons was recorded in the various groups. These included delegates from over forty nations, most of the States, many cities and communities, several of the Federal departments, research and educational institutions, national, State, and local dairy associations, and many commercial organizations and individuals. One notable feature of the congress was that all delegates were accorded equal standing, regardless of group affiliation. This policy gave to the assembly a democratic character somewhat unusual in international gatherings under official auspices.

Practically all of the leading nations of the earth were brought together. In the Eastern Hemisphere the roster ranged from Finland to the Union of South Africa and from France to China and Japan, and in the Western Hemisphere from Canada to Argentina. Not only the leading dairy States of the world but those in which little attention has hitherto been given were represented. The cosmopolitan character of the dairy industry was graphically illustrated.

The congress was also unique in that it was a traveling body. The first two days were spent in Washington, D. C., the third day in Philadelphia, Pa., and the remaining time in Syracuse, N. Y., where the Seventeenth National Dairy Exposition was in progress. This plan was adopted chiefly because no single locality seemed to meet all the requirements, and under the circumstances was probably a fortunate solution. Opportunity was thereby afforded to inspect the work of the Dairy Division of the U. S. Department of Agriculture and other branches of the Government, numerous dairy farms and commercial milk plants in the various localities, and many other places of dairy interest. Excursions to the Pacific Coast, the Central West, and the Eastern States were also scheduled in advance of the congress, and at its close others were conducted. One of these took in various points of interest in New York State, including participation in the dedication of the new $600,000 dairy industries building at Cornell University.

The opening of the congress was appropriately held in Washington, and the program there was so arranged as to emphasize its international character and official relationships. At the initial session a message was read from President Coolidge, and subsequently he received the delegates at the White House with a brief address of welcome. Formal greetings were also extended in person by three members of the Cabinet, representing the Departments of State, Agriculture, and Commerce.

Another interesting gathering was a banquet provided by the local dairy interests in the District of Columbia and vicinity on the first evening of the congress. The distinguishing feature of this occasion was the introduction of the official delegates from the various coun-

tries by roll call, each group standing at attention during the rendering of its national anthem and the waving of its flag by Uncle Sam, assisted by Miss Columbia.

The day's program at Philadelphia was in charge of the National Dairy Council. An address of welcome was delivered by Mayor J. Hampton Moore, followed by descriptions of the work of the council with special reference to the results which have been accomplished in the Philadelphia schools. Demonstrations of school work were given, including two short plays enacted by school children showing the value of milk and the importance of the different food constituents in the diet. At a banquet in the evening two additional plays demonstrating the food value of milk for children were presented. The speakers at this banquet were Governor Gifford Pinchot of Pennsylvania; Mrs. Ira C. Wood, director of the Elizabeth McCormick Memorial Fund; and E. W. Langford, ex-president of the Farmers' Union of England.

The stay in Syracuse was devoted largely to sectional meetings each morning, with the remainder of the day left free for attendance at the National Dairy Exposition and other activities. An international dinner occupied the final evening, at which the entire entertainment was provided by the foreign delegations.

In all, the congress and its subdivisions held twenty-seven sessions, each of which as a rule was devoted to a single topic. The program was made up by four subcommittees dealing, respectively, with research and education, industry and economics, regulation and control, and national health, and contained well over two hundred papers. Four languages, English, French, German, and Spanish, were recognized, but abstracts had in practically all cases been prepared in advance and distributed to the delegates in the most familiar language. By this plan linguistic difficulties were reduced to a minimum.

Reference has already been made to the impressive opening session, principally devoted to the addresses of Secretaries Hughes, Wallace, and Hoover, a response given by Professor Porcher of France for the president of the International Dairy Federation, Hon. Jules Maenhaut of Belgium, and the address of the president of the congress, Prof. H. E. Van Norman of the University of California. Of these addresses, Secretary Hughes spoke especially from the viewpoint of international relationships, referring specifically to the benefits to be derived from the free interchange of the findings of research and the importance of fostering agencies tending to promote their wide dissemination. Secretary Wallace likewise, in discussing the interest of the Federal Department of Agriculture, emphasized the stimulation of the spirit of service which is brought about by such a gathering. The address of Secretary Hoover dealt mainly

with the place of dairy products in the improvement of human health and particularly with the importance of milk in child feeding.

In his presidential address, Professor Van Norman showed how this country and Europe have been mutually benefited by the contributions of each toward the advancement of the dairy industry. "We of this country," he stated, "are indebted to Europe for our breeds of dairy cattle, early feeding standards, and our elementary knowledge of dairy chemistry and bacteriology, the pasteurization process, the use of pure cultures, the centrifugal separator, leadership in standardization of export dairy products, and early cooperative organizations. We have materially developed these gifts and have also made our contributions, such as the use of the attractive 1-lb. rectangular butter package for retail trade, the high-grade milk supply for cities, the system of supervision of production and the perfection of commercial pasteurization equipment and methods, application of mechanical refrigeration, the development of labor-saving machinery, the ice cream business, the perfection of milk condensing and milk powder manufacture, State supervision of advanced registry of purebred cows, and the developing of certified milk." Among the problems still pressing for solution he mentioned "the relation of mineral matter to the nutrition of dairy animals, the control of costly diseases, the increased use of mechanical equipment, the influence of larger container units, the application of mechanical refrigeration to geographical distribution, and the growth of cooperative organizations."

The second session of the congress dealt with certain aspects of international trade. The rapid development of this trade in dairy products during the past twenty-five years was discussed in papers by Dr. H. C. Taylor and Dr. J. A. Ruddick, both of whom emphasized the rapid development of dairying in the Southern Hemisphere, especially in New Zealand and Australia. Dr. J. R. Mohler described the danger of spreading diseases and parasites by international trade in cattle, and suggested a cooperative plan whereby nations would agree to standardize methods of inspection and allow only approved animals to pass into or through their territory. Dr. B. M. Anderson, jr., presented a paper on Agriculture and Dairying in the World's Economic Equilibrium, and Professor Porcher described the purpose and work of the International Dairy Federation. To facilitate the accurate distribution of dairy statistics by the International Institute of Agriculture at Rome, Dr. C. Longobardi suggested that all countries where dairying is important take regular censuses of the industry and prepare annual estimates for distribution by the institute.

The final Washington session was devoted to a consideration of the development of dairying in the United States. Hon. F. O. Lowden

discussed dairy cattle associations and their work, and L. D. H. Weld and J. D. Miller various aspects of the marketing problem. Dr. A. C. True told of the methods of carrying on research and education in dairying in the United States through the U. S. Department of Agriculture, State agricultural colleges and experiment stations, and the various secondary schools maintained by States, counties, and local communities. He stated that the colleges now maintain an instruction force of about 150 persons, and that the stations employ about 120 scientists who are working on some 150 projects with dairy cattle and about 118 on dairy products.

The more technical and specialized papers were for the most part presented in the five days at Syracuse, where four or five sessions were scheduled simultaneously. Thus, on the first day the subjects considered at the different meetings were the use of evaporated, condensed and dried milk in the dietary, business organizations, cheese problems, and extension methods in dairy education. In spite of careful planning, this system made it frequently impossible for a delegate to hear all the papers in the field in which he was interested, but in view of the size of the program it is difficult to see how considerable of the overlapping could have been avoided. In some of the sessions the papers scheduled were so numerous as to make the presentation of all a physical impossibility.

The entire field of dairying was quite thoroughly coverd. One important session dealt with breeding methods, this including several papers bringing out different phases of the difficulties of breeding in milk production and the method of inheritance of heavy milk-producing tendencies. The development of the milking Shorthorn in England and Australia was also considered. Another session took up diseases of dairy cattle, with a discussion of protozoan diseases, diseases of the digestive system, mastitis, and bovine tuberculosis. Still another session was devoted to the chemistry and bacteriology of milk.

One of the most interesting announcements of the congress was made by Dr. H. M. Evans of the University of California before the session on milk secretion and the nutrition of dairy cows. Dr. Evans reviewed experiments with rats which indicate the presence of a dietary factor essential for reproduction which he called Vitamin X, and furnished evidence to show that this factor differed from the three vitamins A, B, and C. Other papers dealing with the physiology of milk production were given at this session by Dr. Porcher, Dr. H. Isaachsen of Norway, and Dr. G. Koestler of Switzerland, and different phases of the mineral nutrition of dairy cattle were discussed by Dr. E. B. Forbes, Dr. E. B. Meigs, O. Erf, and R. A. Dutcher of this country.

The session devoted to a consideration of the nutritional value of milk brought together another notable group of specialists from this country and abroad. The discussion ranged from the nutritional value and optimum amounts of milk for children to the advantages of dried milk in the Tropics and the relation of a restricted use of milk to a deficiency of Vitamin A and resultant ophthalmia in children in Denmark. Still another session dealt with methods of educating the public to the value of milk and the ways of increasing its consumption.

The control of the quality of dairy products was the theme of several sessions, participation by the European delegates being specially noticeable. Considerable attention was given to problems connected with the quality of milk products, particularly cheese, butter, and condensed milk and milk powders.

Several papers were presented dealing with the materials used in the construction of dairy equipment and the need for standardization. Much interest also was shown in the session on marketing problems, in which R. Manod Owen of Wales outlined the principles of cooperative dairying and E. W. Langford told of the work of the National Farmers' Union in England.

A single morning was available for the discussion of methods of instruction in educational institutions, and a like period for extension work. Considerable information was presented at these sessions as to the status of dairy education in Great Britain, Switzerland, Czechoslovakia, Sweden, Denmark, The Netherlands, Italy, and Canada, as well as this country, and as to dairy extension methods in Great Britain, The Netherlands, and this country.

The conference on dairy publications had as its central theme the systematic exchange of abstracts between the scientific journals of the various countries, largely with a view to facilitating early publication. Professor Porcher, the only foreign delegate present at this conference, expressed a willingness to cooperate but emphasized the need of careful preparation of abstracts if their exchange is to be attempted.

The interest and value of the congress was further enhanced by the holding of meetings by many organizations connected with the dairy industry. Among these were the American Dairy Science Association, the International Association of Milk Dealers, the National Creamery Buttermakers' Association, and the associations of numerous breeds of dairy cattle. The annual convention of the International Association of Dairy and Milk Inspectors, an account of which is given in the notes of this issue of the *Record*, preceded the opening of the congress in Washington.

The attendance at the congress was both large and representative. Many well-known scientists who did not present papers were in evidence as officers of the various sections or on the floor. Recognition of the important contributions to science or other service by many of these men was shown in the conferring of honorary degrees by Syracuse University upon eleven of the delegates, President Van Norman and Dr. Longobardi receiving the degree of Doctor of Laws, and Dr. R. Burri of Switzerland, Dr. J. C. Hastings of Canada, Dr. Isaachen of Norway, Dr. G. Leighton of Scotland, Dr. Orla-Jensen of Denmark, Dr. Porcher of France, Dr. M. Sato of Japan, Sir A. Theiler of the Union of South Africa, and Dr. R. Stenhouse-Williams of England that of Doctor of Science.

The congress was well organized, and the successful manner in which its elaborate program was carried to completion without material modification should be a matter of gratification. Competent observers pronounced it not only the most important international dairy conference ever held, but the greatest international agricultural conference. However this may be, it seems evident that much material benefit was derived. It was far more than an industrial congress, a propaganda for the dairy interests. It was a conference in which the basis which science has given to this important industry was the underlying feature. Whether in the form of scientific papers, the practical operations of this many-sided industry, or plays presented by school children, it illustrated the tremendous advance which research has made and is still making. It expressed the time of day as perhaps has never before been done, for it demonstrated not only the growth of sound theory but the remarkable manner in which it has been put into practice in daily life. A more convincing exposition of the value of research as applied to a great business upon whose efficiency the proper nourishment, health, and welfare of people of every class depend, it is indeed difficult to imagine.

The tangible results of such a gathering are frequently somewhat difficult to evaluate, but it is quite evident that the basis of appraisal should be broader than that of the new knowledge brought forward. The belief was expressed by President Van Norman in the opening hours that the congress would "serve its adherents if it brings into wider use the best fruits of scientific research and if it increases the appreciation of the part which fundamental scientific research contributes to economic progress. If it shall thus secure an added support for such research it will doubly serve. Not of the least importance is the cultivation of that personal and international acquaintance which makes for understanding and for world peace." There is much reason to suppose that the World's Dairy Congress substantially achieved its purpose in all these directions.

RECENT WORK IN AGRICULTURAL SCIENCE.

AGRICULTURAL CHEMISTRY—AGROTECHNY.

Annual reports on the progress of chemistry for 1922, edited by A. J. GREENAWAY (*Ann. Rpts. Prog. Chem.* [*London*], *19* (*1922*), *pp. X+311, figs. 12*).—This report on progress in various lines of chemistry in 1922, continuing the series previously noted (E. S. R., 47, p. 201), includes among others the following sections: Analytical Chemistry, by C. A. Mitchell (pp. 164–181); Physiological Chemistry, by J. C. Drummond (pp. 182–202); and Agricultural Chemistry and Vegetable Physiology, by H. J. Page (pp. 203–233).

Reports of the progress of applied chemistry, 1921 (*Soc. Chem. Indus.* [*London*], *Ann. Rpts. Prog. Appl. Chem., 6 (1921), pp. 625, figs. 2*).—This volume continues for 1921 the survey of progress in various lines of chemistry (E. S. R., 47, p. 9), the subjects including among others Oils, Fats, and Waxes, by J. Allan; Soils and Fertilizers, by E. J. Russell; Sugars, Starches, and Gums, by L. Eynon and J. H. Lane; Fermentation Industries, by A. Slator; and Foods, by G. W. Monier-Williams.

Handbook of chemical preparations, a reference book for workers in chemical laboratories, L. VANINO (*Handbuch der Präparativen Chemie, ein Hilfsbuch für das Arbeiten im Chemischen Laboratorium. Stuttgart: Ferdinand Enke, 2. ed., rev. and enl., 1921, vol. 1, pp. XXIII–812, figs. 95; 1923, vol. 2, pp. XX+887, figs. 27*).—This is the second edition of the volume previously noted (E. S. R., 41, p. 613).

The twentieth convention of the German Society of Food Chemists (*Ztschr. Untersuch. Nahr. u. Genussmtl., 45 (1923), No. 1, pp. 1–78*).—This is the complete report of the annual convention held at Cassel September 28 and 29, 1922.

Chemical technology and analysis of oils, fats, and waxes, J. LEWKOWITSCH, rev. by G. H. WARBURTON (*London: Macmillan & Co., Ltd., 6. ed., rev., 1921, vol. 1, pp. XVIII+682, figs. 59; 1922, vol. 2, pp. XII+959, figs. 19; 1923, vol. 3, pp. VIII+508, figs. 27*).—This is the sixth revision of this well-known treatise (E. S. R., 34, p. 507).

Further observations on the chemistry of cod liver oil, T. F. ZUCKER (*Soc. Expt. Biol. and Med. Proc., 20 (1922), No. 3, p. 136*).—A report is given of further attempts toward isolating the antirachitic factor of cod liver oil (E. S. R., 47, p. 369). On extracting the oil directly with 95 per cent alcohol and saponifying the extract with sodium hydroxid the calcium soaps are precipitated from the aqueous solution along with the unsaponifiable matter and the active substance. On extracting this precipitate with acetone a preparation is obtained which, after a dilution of 1:1,000, is as active as the original cod liver oil and is nontoxic in doses of more than 50 times the curative dose. This purified active material is said to be entirely free from the antixerophthalmic vitamin.

Indian casein.—II, The proportion of fat in casein, D. M. GANGOLLI and A. N. MELDRUM (*Bombay Dept. Indus. Bul. 4 (1921), pp. 9*).—In continuation of the series of papers on Indian casein (E. S. R., 45, p. 510), methods of analyzing casein for fat and removing fat from casein are discussed. The method adopted as most satisfactory for determining the fat content of casein is essentially as follows:

To 15 cc. of N/2 NaOH in a conical separatory funnel is gradually added 1 gm. of finely divided casein, and the whole is shaken until the casein is dissolved. Ether is then added, thoroughly mixed with the solution by a rotatory movement, and allowed to stand until the separation is complete. The ether layer is then transferred through a dry filter paper to a weighed flask and evaporated, and the residue weighed as fat. It is stated that in case it is thought desirable to include the fatty acid along with the fat the alkaline solution of casein is acidified with sulphuric acid before being extracted with ether.

For removing fat from casein, gasoline is recommended in place of ether.

The estimation of fat in casein, G. T. BRAY and F. MAJOR (*Jour. Soc. Chem. Indus., 42 (1923), No. 11, pp. 106 T–110 T*).—A critical examination of various methods of determining fat in casein is reported, as a result of which the Werner-Schmidt method as described by Richmond (E. S. R., 46, p. 113) is recommended as giving the best results. The method of Gangolli and Meldrum noted above is criticized as giving inaccurate results, owing to incomplete extraction of the fat.

Studies in bacterial metabolism.—LXVI, The estimation of small amounts of carbohydrates by bacterial procedures, A. I. KENDALL and S. YOSHIDA (*Jour. Infect. Diseases, 32 (1923), No. 5, pp. 355–361*).—This and the three papers following form a part of an extensive series of studies on bacterial metabolism, some of which have been noted previously (E. S. R., 46, p. 179).

The method described depends upon the principle that "any carbohydrate possessing the requisite stereoconfiguration to fit specific microbic protoplasmic asymmetry is utilized more readily for energy than nitrogenous protein derivatives when both are present. The adaptation of this principle to the present problem depends on the degree of refinement to which current methods may be shaped." As the most delicate measure of the action of microbes on utilizable carbohydrates, the increase in H-ion concentration of the medium in which they are developing has been selected, while the return toward neutrality and subsequent development of alkalinity serve to indicate that the sugar has been used up. The H-ion concentration is determined colorimetrically at definite intervals of time by comparison with standards of known H-ion concentration.

It is stated that 0.001 per cent of levulose represents approximately the limit of precison of the method as described. The changes in reaction generally occur in from 2 to 4 hours, while 6 hours are usually sufficient to develop the full intensity of the reaction in the weaker sugar solutions.

Studies in bacterial metabolism.—LXVII, Carbohydrate identification by bacterial procedures, A. I. KENDALL (*Jour. Infect. Diseases, 32 (1923), No. 5, pp. 362–368*).—The object of the present paper was to suggest some of the possibilities of microbic chemistry and to discuss briefly the application of bacteria to the identification of closely related carbohydrates. It is emphasized that "before definite application of bacteria to carbohydrate identification can be taken advantage of, however, it is obvious that certain standards must be established. Two independent factors are involved: First, a set of carbo-

hydrates of unimpeachable purity, suitably made up into nutrient mediums, and second, a library of microbes to act on these carbohydrates in known and constant ways." With these standards and under carefully controlled conditions of initial H-ion concentration, it is considered possible to identify by means of the changes in H-ion concentration any carbohydrate occurring as an impurity in another carbohydrate, provided the amount of impurity equals or exceeds about 0.00003 gm. per cubic centimeter of medium.

The accompanying table summarizes the reactions given by the various carbohydrates with the bacteria employed, the plus signs indicating an increase in H-ion concentration alone:

Fermentation reactions with various bacteria.

Microbic reagent.	Sugar.					
	Glucose.	Fructose.	Mannose.	Galactose.	Lactose.	Saccharose.
Bacillus proteus	+	−	−	+	−	+
Micrococcus tetragenus	+	+	−	+	−	−
Vibrio cholerae	+	+	−	+	+	+
Vibrio of Finkler and Prior	+	+	+	−	−	+
B. typhosus	+	+	+	+	−	−
B. coli I	+	+	+	+	+	−
B. coli II	+	+	+	+	+	+

Studies in bacterial metabolism.—LXVIII, The measurement of carbohydrate mixtures by bacterial procedures, A. I. KENDALL and S. YOSHIDA (*Jour. Infect. Diseases, 32 (1923), No. 5, pp. 369–376*).—This paper describes an extension of the method outlined in the previous paper for single carbohydrates to the identification of two or more carbohydrates if present simultaneously.

Studies in bacterial metabolism.—LXIX, Carbohydrate configuration and bacterial utilization, A. I. KENDALL, R. BLY, and R. C. HANER (*Jour. Infect. Diseases, 32 (1923), No. 5, pp. 377–383*).—In this study an attempt was made to determine what part of the hexose molecule excites the greater influence in determining fermentability, the terminal group or the interterminal arrangement of H and OH groups. A series of derivaties differing from the sugars from which they were prepared merely in the character of the terminal group was prepared from *d*-glucose, mannose, and galactose, and these together with the alcohols sorbitol, dulcitol, and mannitol were fermented as in the previous studies.

In general the aldose and ketose hexose sugars were readily fermented by the majority of the strains, while the corresponding alcohols mannitol, sorbitol, and dulcitol were fermented with increasing difficulty. Gluconic, saccharic, galactonic, and mannonic acids were easily fermented and monosaccharic acid lactone, and mucic acid not. "The evidence deduced from this study throws little additional light on the relation between the configuration of certain hexose sugars and their derivatives and their utilizability by the more common laboratory strains of bacteria which are parasitic on or pathogenic for man."

Chemistry of the antiscurvy (antiscorbutic) vitamin (*Wisconsin Sta. Bul. 352 (1923), pp. 13, 14*).—In continuation of the investigation by Lepkovsky of the chemical properties of vitamin C (E. S. R., 47, p. 805), it is reported that this vitamin is destroyed by certain types of organisms which are lactic acid formers. This is thought to indicate that the vitamin may belong to the carbohydrates or closely allied substances.

Denatured alcohols for fat extraction test (*Wisconsin Sta. Bul. 352 (1923), pp. 91, 92*).—A study by H. H. Sommer and K. V. Bryan of various substitutes for ethyl alcohol for the Röse-Gottlieb extraction has shown that ethyl alcohol denatured by the addition of one-tenth of its volume of methyl alcohol or with one-tenth its volume of ether and three-twentieths of ammonia gives good results. Methyl alcohol and isopropyl alcohol alone were unsatisfactory.

The detection of milk in breadstuffs, G. Kappeller, A. Gottfried, and W. Reidemeister (*Ztschr. Untersuch. Nahr. u. Genussmtl., 45 (1923), No 1, pp. 65–69*).—The authors suggest the determination of the total alkalinity expressed in cubic centimeters of N NaOH, and of the calcium oxid content, as a means of detecting the presence of milk in breadstuffs. Data are presented showing that in milk breads made with wheat flour the alkalinity is in general above 2 cc. of N NaOH and the calcium oxid at least 100 mg. in 100 gm. of dry matter.

Method of analysis of cacao butter and mixtures of cacao butter with other vegetable oils, M. Pichard (*Compt. Rend. Acad. Sci. [Paris], 176 (1923), No. 18, pp. 1224–1226, figs. 2*).—The method described is based on observations of the variation of temperature in function of time of cacao butter or the total fat extracted from the product to be analyzed submitted after melting to slow cooling until completely congealed. The apparatus for the determination consists essentially of two glass tubes, one within the other, the outer one serving as a jacket with openings for the cool air to enter and leave. In such an apparatus the curve of cooling, expressed as a function of temperature and time, is said to vary with the fat used. Typical curves are given for pure cacao butter, palm oil, mixtures of the two, and for various other animal and vegetable fats.

A rapid and accurate quantitative method for the determination of arachidic and lignoceric acids, with special reference to peanut oil analysis, C.-L. Yu (*Diss., Columbia Univ., New York, 1922, pp. 34*).—Essentially noted from a paper by Thomas and Yu (E. S. R., 48, p. 712).

Note on the sulphuric acid reaction for liver oil, H. D. Richmond and E. H. England (*Analyst, 47 (1922), No. 559, p. 431*).—The use of liquid paraffin or petroleum oil in place of petroleum ether is recommended for the sulphuric acid test for liver oils described by Drummond and Watson (E. S. R., 48, p. 758). The technique for the modified test is as follows:

"To 10 cc. of liquid paraffin (B. P.) add 1 cc. of the cod liver oil to be tested. Mix well and by means of a pipette run 10 drops of this into a white porcelain basin, add 1 drop of sulphuric acid (B. P.), and stir with a glass rod. If a transient purplish color develops, add petroleum oil in successive 5 cc. quantities till no purple is given, and record the dilution at which a faint transient purple was seen. If no purple is seen, add successively 1 cc., 1 cc., 2 cc., and 5 cc. of cod liver oil."

Note on the sulphuric acid test for fish liver oils, N. Evers and H. J. Foster (*Analyst, 48 (1923), No. 563, pp. 58–60*).—The authors have found that in the sulphuric acid test for liver oils, as described by Drummond and Watson, the addition of an oil which in itself gives no color with sulphuric acid increases to a marked extent the sensitiveness of the test. This being the case, it is thought that the results given by two oils with the color test can not be compared unless the maximum sensitiveness is secured by the addition of another oil. Other conditions essential for the test are thought to be a large surface of sulphuric acid in contact with the solvent and a minimum time of contact between the two. To accomplish the first it is recommended that the sulphuric acid be shaken violently with a portion of the solvent, and the mixture then added to a solution of the oil in the remainder of the solvent.

The best solvent is thought to be petroleum ether, boiling point from 40 to 60° C., which has been thoroughly shaken with sulphuric acid and then separated. The technique adopted is as follows:

To the required amount of oil in a test tube are added 2 drops of olive oil, or some other natural oil which in itself gives a negative sulphuric acid test, and petroleum ether to 3 cc. To this is then added a mixture of 7 cc. of petroleum ether and 1 drop of concentrated sulphuric acid which has just been shaken violently in a small stoppered cylinder. The drops of acid are said to sink rapidly to the bottom, with the formation of a violet color in the petroleum ether.

A table is given of the results obtained with this test on various samples of oils with the addition of olive oil. In 4 samples of butter the minimum quantity giving a color was 0.2 cc. Of unrefined and refined Norwegian cod liver oil 0.035 cc. was required, while 4 samples of North Sea or Newfoundland cod liver oil gave values of 0.015 cc. It is noted in this connection that the Norwegian oils were of a lighter color than the North Sea oils. Other values reported are for whale oil 0.015, ling liver oil 0.02, mixed liver oil of unknown origin 0.07, and cod liver stearin 0.08 cc.

Contribution to milk studies, Gronover (*Ztschr. Untersuch. Nahr. u. Genussmtl., 45 (1923), No. 1, pp. 18–24*).—This is a brief discussion of the value of freezing point determinations for detecting watered milk.

The reductase test of Barthel and Jensen, J. Smith (*Jour. Hyg. [London], 21 (1922), No. 2, pp. 139–141*).—A comparison of the bacterial content of 132 milk samples by the dilution method and the reductase test is reported with the following results:

Fifty-nine of the samples gave a bacterial count of under 100,000, 36 from 100,000 to 500,000, 26 from 500,000 to 4,000,000, 9 from 4,000,000 to 20,000,000, and 2 over 20,000,000. The reductase test gave comparable results in 109 of the samples and considerably higher results in the remaining 23 samples. The discordant results were chiefly in the samples giving bacterial counts from 100,000 to 500,000. It is concluded that when there are large numbers of organisms present the reductase test gives as accurate an estimate as the plate method, but that in its present form the test would not be of service in grading milk according to bacterial standards.

Preparation and comparison of standards for the estimation of creatin and creatinin, G. Edgar (*Jour. Biol. Chem., 56 (1923), No. 1, pp. 1–6*).—The advantages and disadvantages of several proposed standards for creatin and creatinin determinations are discussed briefly, methods of preparing creatinin zinc chlorid and creatinin picrate are described, and a general report is given of a comparison of these salts as standards.

The method employed for the preparation of creatinin zinc chlorid consists in grinding commercial creatin in a mortar with an equal weight of zinc chlorid, transferring the mixture to a beaker or casserole, and heating it slowly with constant stirring over a small flame until it melts and suddenly solidifies. The residue is dissolved in 10 times its weight of boiling 25 per cent acetic acid, and 2 volumes of alcohol are added. On cooling, pure creatinin zinc chlorid separates in practically quantitative yield. Creatinin picrate is prepared from commercial creatin by dissolving it in an excess of hydrochloric acid, evaporating the creatinin chlorid thus formed to dryness on a water bath, dissolving it in a little water and adding it to a slight excess of picric acid previously dissolved in boiling water or alcohol. The precipitated creatinin picrate is filtered off, washed with a little cold water, recrystallized once from boiling water, washed with alcohol, and dried at 100° C.

Comparable results within the range of experimental error were obtained with both standards. The picrate is considered to have the advantage of having a definite melting point and of being stable over considerable intervals of time, but to have the disadvantage of a limited solubility.

The reciprocal transformation of creatin and creatinin.—V, The determination of creatin in muscle tissue, A. HAHN and L. SCHÄFER (*Ztschr. Biol., 78 (1923), No. 3–4, pp. 155–160*).—Continuing the series previously noted (E. S. R., 49, p. 560), various methods of determining creatin in muscle tissue are criticized on the ground that during the process of removing the protein there is a loss of creatin through its transformation into creatinin by the action of hydrochloric acid at the high temperature employed. To avoid this loss the following technique is recommended:

Fresh muscle is freed as far as possible from fat and tendons and ground fine in a meat grinder. Of the finely ground material 40 gm. is heated for 10 minutes in a porcelain dish with 150 cc. of 5 per cent salt solution after the addition of 20 drops of 10 per cent acetic acid. The supernatant liquid is filtered through a folded filter paper, and the residue is heated twice for 5 minutes with 150 cc. of water. The combined filtrates are made up to 1 liter, of which 100 cc. is treated with 50 cc. of a 10 per cent trichloracetic acid, and 100 cc. of the water-clear and protein-free filtrate is transferred to a flask provided with a tightly fitting rubber stopper. The excess trichloracetic acid is neutralized with 50 per cent sodium hydroxid after the addition of 3 drops of a 1 per cent solution of *p*-nitrophenol in 96 per cent alcohol. After the addition of 100 cc. of 2 N HCl, the flask is shaken well and left for 24 hours in the thermostat at 65° C. to change the creatin to creatinin. The creatinin determination is then continued as in the method for blood described in a previous paper (E. S. R., 48, p. 808).

Data are reported on the creatin content of horse and beef muscle. In both the values obtained lay between 0.4 and 0.5 per cent, values considerably higher than those reported by previous investigators.

A study of some of the factors affecting the moisture absorption of raw and refined cane sugars, W. L. OWEN (*La. Planter, 70 (1923), Nos. 5, pp. 88–90; 6, pp. 107, 108*).—The first point investigated in this study of the extent to which sugars in the same class vary in their moisture absorption and the reasons for these differences was the influence of the size of grain upon moisture absorption. Five samples of 96-test sugars ranging in size from Nos. 3 to 8 were exposed for varying periods of time to different degrees of humidity and the moisture absorption determined. The results obtained showed that the moisture absorption in a general way is inversely proportional to the size of the grain. A comparison was then made of the moisture absorption of plantation granulated sugar with that of a standard sugar. The absorption of the former was greater during the first 24 hours but less over a period of 96 hours.

To determine the influence of impurities upon the rate of moisture absorption of sugars, gums from Cuban molasses were precipitated with alcohol, diluted to a definite volume, and added to sugar in amounts equivalent to 0.2 and 0.4 per cent. After the sugars were dried thoroughly the ability to absorb moisture was found to be 5 per cent greater for the 0.2 per cent gum and 22 per cent greater for the 0.4 per cent gum than for the standard granulated sugar used in the comparison. The addition of ash obtained from raw sugars, lime, or reducing sugar to standard granulated sugar was also found to increase greatly its rate of moisture absorption.

A study of the comparative rate of moisture absorption of plantation white and refined granulated sugars, W. L. OWEN (*La. Planter, 70 (1923), No. 22, pp. 469–471*).—In continuation of the above investigation, a more detailed comparison was made of the moisture absorption of plantation sugars and refined granulated sugar under two conditions, (1) over water furnishing conditions of 100 per cent humidity and (2) over a 25° Brix sulphuric acid solution. Fifteen samples of plantation sugars were analyzed for sucrose by the Clerget method and for moisture content and were then exposed to the two degress of humidity for varying periods of time, with determinations of moisture absorption at the end of each period.

The average ratio of moisture absorption of all of the samples of plantation sugars to that of the refined sugar was 1:1.62 over water and 1:1.87 over the sulphuric acid solution. In both series approximately one-third of the samples proved superior to the refined sugar as regards moisture absorption. It is concluded that the hygroscopic nature of white sugars is determined to a larger extent by the size and uniformity of the grain than by the nature of the traces of impurities present.

A study of the "factor of safety" of sugars, with special reference to methods required for the manufacture of sugar conforming thereto, W. L. OWEN (*Internatl. Sugar Jour., 24 (1922), Nos. 287, pp. 581–586; 288, pp. 644–647*).—The author reports an investigation conducted at the Louisiana Sugar Experiment Station to determine on a laboratory scale how sugars and molasses can be made to conform to the "factor of safety." The experimental data reported include the composition of sugars made in the laboratory from sirups of various purities, and the deterioration of these sugars when inoculated with species of mold fungi and stored for definite periods. From an analysis of these data the following conclusions are drawn:

"The validity of the 'factor of safety' as a criterion of the keeping quality of sugars is due to the fact that it denotes a molasses film surrounding the sugar crystals unsuitable for the growth of microorganisms capable of causing its deterioration. The value of the 'factor of safety' varies with the type of infection present, the purity of the molasses film, and also the surface distribution, i. e., the size of the crystals. It is also probable that the value of the 'factor of safety' depends upon whether the moisture of the film is homogeneously incorporated therein or existing as an outer zone of dilute molasses. For raw sugars to conform to the 'factor of safety' they must crystallize in a magma of such purity that their molasses films will be unsuitable, either in density or composition, for the growth of microorganisms. To manufacture such sugars, a good clarification of the juice is required, so that the proper exhaustion of the molasses may be secured."

A review of the literature on decolorizing carbons, J. F. BREWSTER (*La. Planter, 70 (1923), No. 22, pp. 471–473*).—This review covers the literature of the past three years on the manufacture, uses, method of action, and evaluation of decolorizing carbons and methods of regenerating spent carbons.

METEOROLOGY.

The air and its ways, N. SHAW ([*London*]: *Cambridge Univ. Press, 1923, pp. XX+237, pls. 28, figs. 71*).—This book is a collection of "lectures and essays" by the author, dealing with "the physical explanation of the atmospheric circulation," and of papers "designed to set out the present position of the application of meteorology to agriculture." The titles of the papers included are Meteorology for Schools and Colleges, Pressure in Absolute Units, The Meteorology of the Globe in 1911, The Weather of the World, The First

Chapter in the Story of the Winds, The Drought of 1921, The Cyclonic Depressions of Middle Latitudes, The Structure of the Atmosphere up to Twenty Kilometers, The Air and Its Ways, The Organization of the Meteorological Office in London with Special Reference to Agricultural Meteorology, Climatological Stations and Local Authorities, The Law of Sequence in the Yield of Wheat for Eastern England—1885–1905, Meteorology and Agriculture, The Weather, and The Artificial Control of Weather. In an appendix is given a paper by S. Fujiwhara, on Acceleration of the Air by Falling Rain. Many of the papers in this collection bearing on the relation of meteorology to agriculture have been previously noted (E. S. R., 18, p. 713; 29, p. 120; 31, p. 212; 34, p. 319; 45, p. 319).

A number of new lines of fundamental investigation are suggested.

A rainfall period equal to one-ninth the sun spot period, D. Alter (*Kans. Univ. Sci. Bul., 13 (1922), No. 11, pp. 17–99, figs. 10*).—This paper reports the completion of investigations, previously referred to (E. S. R., 45, p. 17), "using much longer records and the data from the United States, northern Europe, central Siberia, the Punjab in India, Chile, South Australia, Jamaica, and Madagascar. Numerous tables and curves are given. The conclusion reached is that the period does exist, and that the relationship to sun spots is not a direct one, but due to an unknown common cause. In purely continental areas, minimum rainfall is connected with a maximum of sun spots; in purely marine, with a minimum of sun spots. For areas with rainfall between these types the period is not plainly found."

An experiment in frost protection by means of artificial clouds, M. Chassant and R. Clarté (*Ann. Sci. Agron. Franç. et Étrangère, 40 (1923), No. 2, pp. 88–91, fig. 1*).—The successful use of a cover of dense, heavy fumes of metallic oxid produced by a Berger engine (designed originally for war purposes) as a protection against frosts in vineyards in the region of Montpellier is reported.

Climatological data for the United States by sections (*U. S. Dept. Agr., Weather Bur. Climat. Data, 10 (1923), Nos. 3, pp. [200], pls. 4, fig. 1; 4, pp. [191], pls. 4, fig. 1*).—These numbers contain brief summaries and detailed tabular statements of climatological data for each State for March and April, 1923.

Climate of British Columbia, compiled by F. N. Denison (*Brit. Columbia Dept. Agr. Bul. 27, 8. ed. (1923), pp. 19*).—This edition brings the record up to the end of 1922. "The year 1922 was unusually fine, dry, and warm during the summer months and abnormally cold in winter."

Norms of temperature, rainfall, and sunshine of Minas Geraes, Brazil, 1914 to 1921 (*Boletim de Normaes de Temperatura, Chuva e Insolação Correspondentes aos Annos de 1914 a 1921. Bello Horizonte, Brazil: Sec. Agr., Indus. [etc.], Minas Geraes, Serv. Met., 1923, pp. 208, pls. 3*).—Detailed data, calculated to 10-day periods, as recorded at numerous stations throughout the country, are reported in tables and charts.

The weather of Scotland in 1922, A. Watt (*Highland and Agr. Soc. Scot. Trans., 5. ser., 35 (1923), pp. 260–268*).—"This report consists of (1) a general description of the weather over the Scottish area from month to month; (2) a selection of rainfall returns in which each county in Scotland is represented by one or more stations. . . .

"The outstanding features of the weather of 1922 were the very cold April, the cold and rather cloudy summer, and the prevalence of mild conditions toward the end of the year. The infrequency of thunderstorms during the summer may also be noted. Over much the greater part of Scotland the year's rainfall was rather below the normal."

SOILS—FERTILIZERS.

Soils, M. FLEISCHER (*Die Bodenkunde. Berlin: Paul Parey, 1922, 5. ed., rev., pp. X+248, pls. 2*).—This is the fifth revised edition of this book.

Soil fertility, soil exhaustion, and their historical significance, A. P. USHER (*Quart. Jour. Econ., 37 (1923), No. 3, pp. 385–411*).—In a contribution from Harvard University a summary is given of factors involved in the maintenance and exhaustion of soil fertility, and the historical significance of these factors is discussed.

Report of the third annual meeting of the American Association of Soil Survey Workers (*Amer. Assoc. Soil Survey Workers Rpt., 3 (1922), pts. 1, pp. [2]+88; 2, pp. [2]+89–179*).—The proceedings of this meeting are presented in two volumes. Volume 1 contains, among other things, special papers on Outlines and Systems of Collecting Adequate Field Notes, by W. T. Carter, jr.; Relative Importance of Such Factors as Color, Structure, Soil Layers, Mottling, Lime Content, etc., in Soil Differentiation, by W. E. Tharp; Variations within the Soil Type, by D. S. Gray; Acidity Tests as an Aid in Soil Survey Work—Laboratory Viewpoint, by S. D. Conner; Acidity Tests as an Aid to Soil Survey Work—the Field Man's Viewpoint, by T. M. Bushnell; Drumlins and the Problems Which Arise in Mapping Them, by H. G. Lewis; The Soil Type as a Basis of Establishing Experimental Fields, by H. J. Snyder; Utilization of Soil Surveys, by C. F. Shaw; Description of Field Methods Followed by the Michigan Land and Economic Survey, by L. R. Schoenmann; The Soil Survey—Present and Future, by P. S. Lovejoy; Progress of Soil Survey Work in Canada, by C. B. Clevenger; Some Neglected Soil Investigations, by H. H. Bennett; Possibilities of the Airplane in Soil Survey Work, by W. B. Cobb; and Cooperative Work between the Bureau of Soils and the Reclamation Service, by A. T. Strahorn.

Volume 2 contains the reports of committees on soil color standards, publicity and information, improvement of soil, correlative laboratory work, future field of the soil survey workers' association, and on classification of organic soils, and special papers on The Need of Color Standards for Use in the Field, by A. M. O'Neal; The Improvement of Soil Survey Reports, by J. O. Veatch; Some Suggestions Regarding Soil Survey Reports and the Soil Survey, by M. H. Lapham; Soil Survey Reports, by H. H. Krusekopf; The Relation between Soil Type and Chemical Composition, by E. E. De Turk; The Classification of Soils for Commercial Purposes, by C. A. Stanton; Soil Studies in Michigan, by M. M. McCool and J. O. Veatch; The Condition of Soil Survey Work in Russia toward the Beginning of the Year of 1923, by N. M. Tulaikov; and Progress of Soil Survey in Ontario, by R. Harcourt.

The cotton soils of the middle Niger (*Bul. Mens. Agence Écon. Afrique Occident. Franç., n. ser., 3 (1922), No. 24, pp. 359–372*).—This is a summary of mechanical and chemical analyses obtained from different sources of samples of the cotton soils from the basin of the middle Niger River in French West Africa. The mechanical analyses have indicated that the soils of this valley are predominantly very light, usually consisting of a siliceous soil and a siliceous argillaceous or argillaceous siliceous subsoil. The content of coarse particles is generally satisfactory. Heavier and more plastic soils are said to occur on the banks of the river. The chemical analyses indicate that these soils are generally deficient in nitrogen and phosphoric acid, but that they are well supplied with lime and potash.

Forest soils of Ceylon, A. Bruce (*Ceylon Dept. Agr. Bul. 61 (1923), pp. 30*).—Mechanical, physical, and chemical analyses of 52 samples of soils typical of the different Provinces of the island of Ceylon are presented and discussed.

Effect of chemical agents on oxidation in soil-forming rocks and minerals, G. J. Bouyoucos (*Soil Sci., 15 (1923), No. 1, pp. 19–22, fig. 1*).—Studies conducted at the Michigan Experiment Station on the effect of 12 chemical agents in N/10 solutions, with one exception, on 26 soil-forming rocks and minerals are reported.

The results indicate that the different chemical agents have a very decidedly different effect on the oxidation of iron as regards both rate and extent. It is thought that the dominant nonoxidizing effect of some of the chemical agents may prevent the oxidizing effect of other chemical agents. Oxidation will take place even when the material is immersed under a deep column of liquid, and even when the freer circulation of atmospheric oxygen is excluded. It is thought that these results should throw light on the oxidation and color of soil at various depths, on the influence of fertilizers on oxidation and color of soil, and on the oxidation and color of the substratum of the earth.

Ultimate analysis of the mineral constituents of a Hagerstown silty clay loam soil and occurrence in plants of some of the elements found, W. Thomas (*Soil Sci., 15 (1923), No. 1, pp. 1–18*).—Studies conducted at the Pennsylvania Experiment Station in connection with an investigation of the effect of fertilizers on the yield, growth, and other physiological functions of the apple tree are reported. The main study is being conducted in 42 steel rims, and the soil used was taken from a strip of virgin land adjacent to the experimental orchard.

The rarer elements vanadium, chromium, molybdenum, zirconium, rubidium, caesium, and lithium have been isolated and identified by qualitative and quantitative methods, said to be of indisputable validity, from this residual soil, Proof is presented of the presence of barium and strontium, which is said to be the first observation of these elements in this phase of the Hagerstown series of soils. The results for barium are believed to be accurate, while those for strontium are approximate, since complete separation from calcium was not obtained.

The calcium and magnesium are derived not only from dolomite, but to a considerable extent from the silicates amphibole and chlorite. Although this soil is formed from limestone rocks it contained no calcium carbonate, and magnesium was present in larger amounts than calcium. The chief sources of potassium in this soil are said to be microcline and the mixed feldspars of acid variety. Mica is present only as an accessory, and the orthoclase has been practically all kaolinized.

The existence of iron in the ferrous condition was definitely established, and the greater portion of the sulphur was found to exist either in the free state or in organic combination. All three soil layers contained only a trace of chlorin.

A review is given of the literature on the occurrence of the rarer elements in plants, and it is stated that accurate methods for the determination of boron and fluorin in soils should be developed.

Movement of soil moisture from small capillaries to the large capillaries of the soil upon freezing, G. J. Bouyoucos (*Jour. Agr. Research [U. S.], 24 (1923), No. 5, pp. 427–432, pl. 1*).—In a contribution from the Michigan Experiment Station, evidence is presented which shows that when a soil short of saturation is frozen, the force of crystallization tends to draw the moisture from the small capillaries and from around the particles as thick films into the larger capillaries.

"However, when the soil is wet or saturated, under proper conditions the moisture freezes at the surface of the soil and forms capillary ice columns or thin needle-like crystals. The force of crystallization draws the water from below, which freezes at the lower end of the column and pushes the entire column upward. The relative distribution of the capillary water is between the finer and the larger capillaries and may have a very appreciable effect upon such factors as freezing-point depression, vapor-pressure lowering, osmotic pressure, and rate of evaporation. Any treatment of the soil which will alter the relative distribution of the soil moisture as between the finer and larger capillaries would seem to affect these factors."

Studies on the H-ion concentration of the soil and its significance to the vegetation, especially to the natural distribution of plants, C. OLSEN (*Compt. Rend. Lab. Carlsberg, 15 (1923), No. 1, pp. 166, figs. 27*).—This is an extensive report of studies made to determine what significance may be attached to the H-ion concentration in the soils of Denmark, with particular reference to the distribution of vegetation.

The H-ion concentration in natural Danish soils was found to vary from 3.4 to 8 expressed in pH. The H-ion concentration of these soils appeared to have an essential influence on the composition of the plant formations, as single species only were found in soils the H-ion concentration of which lay within a certain range characteristic of each single species. Within this range there was found a narrower range in which the species had its greatest average frequency. This is taken to indicate that when the plant formations are not too deficient in species, conclusions as to H-ion concentration of the soil may be drawn from the composition of the vegetation. The number of species and their density were on an average greatest in soils the H-ion concentration of which was near the neutral point. As the H-ion concentration increased, both the number of the species and their density generally decreased.

A number of water culture experiments showed that species which are found in nature only on very acid soil reached their best growth in nutrient solutions the pH values of which were near 4, while species which are found in nature only on slightly acid, neutral, and alkaline soils reached their most vigorous growth in nutrient solutions the pH values of which lay between 6 and 7. The so-called acid soil plants did not thrive well and became chlorotic in the slightly acid nutrient solutions in which the alkaline soil plants reached their best growth.

Aluminum ions were not found toxic to alkaline soil plants in general. This is taken to disprove the general validity of the theory set up by Hartwell and Pember that the inability of alkaline soil plants to thrive in very acid soils is due to the existence therein of small quantities of dissolved aluminum compounds.

It is stated that the theory advanced by Bear and others that acid soil plants are those which are able to use ammonia nitrogen, while alkaline soil plants demand nitrate nitrogen and therefore can not thrive in very acid soils, is incorrect. In this connection the experiments showed that ammonia nitrogen and nitrate nitrogen are of the same value as sources of nitrogen for both acid and alkaline soil plants.

The quantity of plant nutrients in the soil did not influence plant distribution to any great extent. It also appeared that there are alkaline soils which are deficient in nutrients, the vegetation of which showed no resemblance to that of very acid soils deficient in nutrients. These results are taken to indicate the probability that the H-ion concentration of the soil as such exercises a considerable influence on the composition of the vegetation.

Soil reaction and plant life, with special reference to lime requirements for plant production, O. ARRHENIUS (*Bodenreaktion und Pflanzenleben mit spezieller Berücksichtigung des Kalkbedarfs für die Pflanzenproduktion. Leipzig: Gustav Fock, 1922, pp. 19, pls. 2, figs. 3*).—This publication describes different methods of determining the reaction and lime requirement of soils, and summarizes data on the relation between soil reaction and the growth of different crops. From these data common crops are listed in the order of their sensitiveness to acidity.

Measuring soil acidity by alkaline liquids, V. VINCENT (*Compt. Rend. Acad. Sci. [Paris], 175 (1922), No. 24, pp. 1233, 1234*).—Studies made to explain the differences between the action of limewater and of bicarbonate solutions on acid soils are reported. These included experiments to show separately the action of the hydrates of iron, aluminum, and silica on limewater and on solutions of calcium and sodium bicarbonates, using weak concentrations of metals similar to those occurring in the soil.

It was found that in the presence of an excess of calcium hydrate ferric hydrate is totally precipitated, carrying along with it a variable quantity of lime. The ratio between the lime fixed by a constant quantity of ferric hydrate and the total lime in the solution decreased with the concentration of the lime and tended toward an equimolecular combination of ferric hydrate of lime. Where the lime was combined with sugar, a constant quantity of ferric hydrate fixed a quantity of lime corresponding to the free lime present. With aluminum hydrate, limewater precipitated insoluble crystal calcium aluminate. The hydrate of silica was precipitated completely by limewater in amorphous form. A saturated solution of calcium bicarbonate without an excess of carbonic acid gave variable results. The ferric hydrate and hydrate of silica had no action under the same experimental conditions. On the other hand, all of the aluminum hydrate entered into combination, resulting in insoluble calcium aluminate.

These results are taken to indicate that, since the organic matter of the soil combines more completely with lime than with bicarbonates, the acidity of soils may be measured better with limewater than with bicarbonates. In addition, the determination of soil acidity by the use of alkaline bicarbonates does not indicate organic acidity nor that due to the salts of aluminum and to free aluminum.

Effect of acid soils on nodule-forming bacteria, O. C. BRYAN (*Soil Sci., 15 (1923), No. 1, pp. 37–40*).—Studies conducted at the University of Wisconsin on the effect of acid soils of known reactions on a few of the important nodule-producing organisms are reported.

The study dealt specifically with the ability of alfalfa, red clover, and soy bean bacteria to live and produce nodules 75 days after being placed in acid soils of different degrees of acidity. The alfalfa bacteria were killed at about pH 5, the red clover bacteria at from about pH 4.5 to pH 4.7, and the soy bean bacteria at from pH 3.5 to pH 3.9. The critical H-ion concentration in the soil was found to be approximately the same as in pure cultures. The texture of the soil seemed to have no appreciable influence in the critical H-ion concentration for these bacteria. The results are taken to indicate the necessity of frequent inoculation and liming of acid soils.

A study of the effect of changing the absolute reaction of soils upon their Azotobacter content, P. L. GAINEY (*Jour. Agr. Research [U. S.], 24 (1923), No. 4, pp. 289–296*).—Studies conducted at the Kansas Experiment Station in an attempt to control the Azotobacter content of soil by varying the reaction are reported, and the results of a few typical examples of a large,

number of experiments that have been carried out along this line are presented and discussed.

These showed that if two soils, one more acid than pH 6 and containing no Azotobacter and the other less acid than pH 6 and containing Azotobacter, are mixed in varying proportions, incubated, and tested for Azotobacter, all mixtures having an acidity less than pH 6 will contain Azotobacter, while all cultures very much more acid than pH 6 will not.

It was further found that if sufficient calcium carbonate is added to a soil more acid than pH 6 and not containing Azotobacter to reduce the concentration to less than pH 6, the soil will support Azotobacter. If sufficient acid is added to a soil less acid than pH 6 and containing Azotobacter to increase the acidity to a point very much greater than pH 6, Azotobacter will disappear from the soil provided this acidity exists for a time sufficient to complete their destruction.

[**Soil fertility studies at the Wisconsin Station**] (*Wisconsin Sta. Bul. 352 (1923), pp. 77–79, fig. 1*).—Studies, by E. J. Graul and E. B. Fred, of the effect of liming and inoculation on the nitrogen-fixing capacity of legumes showed that a partial neutralization of existing acidity in the soil is necessary to secure maximum production, and that a thorough inoculation of the legume helps it to overcome the unfavorable effects of soil acidity. Studies by Fred and A. C. Fiedler on the influence of plowing under green brush on the growth of cereal crops showed that green alder and green poplar were quite injurious to oats, while green willow and green birch caused only a slight injury.

The efficiency of legume inoculation for Arizona soils, R. S. Hawkins (*Arizona Sta. Tech. Bul. 4 (1923), pp. 61–85, figs. 8*).—Studies to determine the effect of the symbiotic nitrogen-fixing *Bacillus radicicola* upon the growth and nitrogen content of various legumes and upon the nitrogen content of the soil are reported.

Inoculation did not prove beneficial with alfalfa on a tight-textured clay loam soil, but in most instances appeared to be of advantage on a very poor clay soil containing considerable sand. Inoculation hastened maturity from five to seven days with alfalfa grown in pots, and the weights of the tops and of the roots of all legumes experimented with in pot tests were increased materially by inoculation.

The increase in the yield of vetch ascribed to inoculation was very marked on very sandy soil. This increase was greater during the first year of cultivation than during the second. In soil where inoculated vetch had been grown the preceding year the yields following the inoculation of vetch seed were increased very materially over those with vetch seed not inoculated. The weight of nodules on the roots of the vetch plants which had not been inoculated was greater than on those which had been inoculated, while the number of nodules per plant was less.

A distinct gain in the nitrogen content of poor desert soil or of river bottom soil which had been in cultivation for a number of years was obtained by growing alfalfa, either inoculated or not inoculated. There was a loss in nitrogen content from the clay loam and poor clay soils. With an application 20 times normal of commercial inoculum in sterile soil, the yield of alfalfa was 3 times as heavy as with a normal application.

Toxicity and antagonism of various alkali salts in the soil, F. S. Harris, M. D. Thomas, and D. W. Pittman (*Jour. Agr. Research [U. S.], 24 (1923), No. 4, pp. 317–338, figs. 13*).—Experiments conducted at the Utah Experiment Station are described in this paper which were planned to show the influence on plant growth of adding other salts, as well as acids and manure, to a soil

already impregnated with sodium carbonate. Some preliminary experiments on soils impregnated with sodium chlorid and sodium nitrate instead of sodium carbonate are also reported.

The results showed that when a given concentration of sodium carbonate in sand is treated with an equal quantity of calcium sulphate or sulphuric acid an appreciable lowering of the toxicity of the carbonate to wheat is evident. This relation was not so manifest in heavier soils, and in such soils sodium sulphate increased the toxicity of the carbonate. It was possible to substitute either sodium chlorid or sodium nitrate in the soil mentioned without changing the results. No antagonism between these salts and the sulphates could be detected in Greenville loam.

Each one of four different concentrations of sodium carbonate already incorporated in the Greenville loam soil was treated with five concentrations of the following substances in groups of three: (1) Sulphuric acid, potassium sulphate, and sodium sulphate, (2) hydrochloric acid, potassium chlorid, and sodium chlorid, (3) nitric acid, potassium nitrate, and sodium nitrate, (4) sodium chlorid, sodium sulphate, and sodium nitrate, (5) sodium arsenite, sodium phosphate, and borax, and (6) calcium sulphate, sulphur, and barnyard manure. The toxicities of all the substances in the first five groups were increased by the specific toxicity of sodium carbonate when they were added to soil already impregnated with this salt. Nontoxic quantities of all of the substances in the first four groups corrected, to some extent at least the harmful effects of moderate, and in some cases of fairly high, concentrations of sodium carbonate. The salts in the fifth group did not exhibit this property. It is thought that this phenomenon may be due in part at least to specific stimulation of plant growth by these substances rather than to any antagonistic action of the sodium carbonate.

Potassium nitrate and nitric acid were both distinctly stimulating to plant growth when applied at the rate of 1,000 parts per million, and the addition of this quantity of these materials to soil containing 5,000 parts per million of sodium carbonate or less was particularly beneficial. Under the conditions of the experiment barnyard manure was an effective amendment for soil containing 2,000 parts per million of sodium carbonate, but its corrective power for more toxic concentrations of black alkali was much less evident, probably because the optimum moisture content of the soil was not maintained when the larger amounts of manure were added. Calcium sulphate alone and in combination with sulphur and manure was the most effective corrective used, particularly on the more toxic black alkali soils.

It is concluded that, while these data throw some light on the antagonistic action of various alkali salts, it is evident that the problem of the alleviation of black alkali trouble is far from being solved.

Alkali soils of the Newlands project, F. B. Headley and E. W. Knight (*U. S. Dept. Agr., Dept. Circ. 267 (1923), pp. 21–26*).—Data on the kinds of alkali in the soils of the Newlands (Nev.) project, the manner of their deposition, and methods of treatment are presented. The alkali salts most commonly occurring on this project in sufficient quantities to be harmful to crops are sodium carbonate, sodium bicarbonate, sodium chlorid, and sodium sulphate. Sodium sulphate is the most common of the salts occurring in the soils of the project.

Experiments in the reclamation of alkali soils, F. B. Headley and E. W. Knight (*U. S. Dept. Agr., Dept. Circ. 267 (1923), pp. 16–20, figs. 5*).—Experiments conducted on the Newlands, Nev., Reclamation Project Experiment Farm during the period 1919–1921 on the reclamation of soils of such a nature that a hard cement-like crust forms after each irrigation or rain are briefly

reported. The treatments given consisted of applications of manure, gypsum, sulphur, and acid phosphates made singly and in combination.

The results show that manure applied alone or in combination was more effective than any other treatment. The percentage of sodium carbonate in the soil materially decreased in all the manured plats, and in some cases, especially where sulphur or gypsum was used, the percentage of sodium sulphate increased. While the results of these experiments are decidedly positive in indicating a benefit from the use of manure in the reclamation of alkali soils, it is considered unsafe to assume that soils of a different type would be improved by the application of manure. Experiments conducted on a heavier soil showed decidedly good results with gypsum and sulphuric acid and no noticeable benefit from manure. It is stated that manure seems more likely to be beneficial on soils of the cement-sand type than on adobe soil carrying black alkali.

[**Fertilizer and soil fertility studies at the Wisconsin Station**] (*Wisconsin Sta. Bul. 352 (1923), pp. 98–110, figs. 7*).—Chemical analysis and greenhouse tests of 26 different soils from 17 counties of the State, to determine their fertilizer requirements, are said to have shown that when a soil is not acid or only very slightly acid, lime is usually not needed for alfalfa. If the soil is slightly acid, however, lime must be used unless the soil is very high in fertility. Most of the 26 soils also responded to phosphate and potash treatment.

In studies of methods of applying fertilizers by H. J. Harper and E. Truog, small amounts of fertilizers gave better results when applied in the drill row than when applied broadcast. The maturity of oats was appreciably hastened by the use of phosphate and potash. Studies of hill application of fertilizer with corn showed that this method did not restrict growth either in amount or extent, and usually caused an increase in root development.

Studies by O. C. Magistad, to determine why such plants as potatoes are easily prevented from growing when fertilizers are applied in certain ways, showed that the osmotic pressure of the juice of potato sprouts and certain other sprouts is very low compared to that of the sprouts of corn. It is considered possible, therefore, for fertilizer in contact with potato sprouts to draw the water out of them and cause them to dry up. Corn sprouts were not nearly so easily affected. This is taken to indicate that in the case of potatoes, fertilizers should not be applied directly over the seed in large amounts, but should be mixed with the soil along both sides of the row. It was further found that the use of fertilizer in the hill may increase the salt concentration of corn sap sufficiently to enable it to withstand a lower temperature than unfertilized corn.

At the Ashland Substation studies of phosphate fertilizers showed that especially good results were obtained where the phosphate fertilizers were applied in combination with manure. A mixture of plant residues and rock phosphate gave better results in some cases than a mixture of manure and acid phosphate.

Studies by C. D. Samuels on the cause of acidity in certain soils led to the conclusion that the original make-up of soil is an important factor in determining the strength of the acid formed on leaching. The results indicated that one of the reasons why some soils become much more acid than others is the larger proportion of certain minerals which they originally contain. Muscovite and biotite were found to be especially abundant in some soils and to weather rapidly into distinctly acid residues. After the organic matter was removed from four different upland soils by treatment with hydrogen peroxid, the soils showed an even greater degree of acidity than before. This is

taken to indicate that the acidity of upland soils is due more to mineral acids than to organic residues.

The results of a comparison by F. W. Parker and O. C. Bryan of the hydrogen electrode, the sugar inversion, and the Truog tests for determining soil acidity on 42 different soils indicated a fairly good correlation between the three methods. The sugar inversion method and the Truog test correlated better than either of them did with the hydrogen electrode method.

Data compiled by F. L. Musbach and A. R. Whitson on the utilization of stable manure showed that top-dressing is a slightly better practice than plowing under. Other experiments showed that while green manure can be used to make the fertility in the soil more rapidly available to crops, the practice in itself is entirely insufficient to maintain crop yields on the soils at the Spooner Substation over a long period. Several years' tillage experiments at the Ashland Substation showed that fall plowing to a depth of 6 or 7 in. in heavy soils is the most satisfactory practice.

Experiments with new fertilizers, SCHNEIDEWIND (*Mitt. Deut. Landw. Gesell., 38 (1923), No. 10, pp. 139–141*).—This is a brief summary of the results of experiments with new fertilizers conducted at the experiment station at Halle. In the nitrogen experiments, sodium nitrate, potassium ammonium nitrate, sodium ammonium nitrate, calcium ammonium nitrate, gypsum ammonium nitrate, ammonium sulphate nitrate, ammonium sulphate, ammonium chlorid, sodium ammonium sulphate, urea, urea nitrate, and lime nitrogen were tested.

The results showed that the ammonium nitrate compounds of sodium, potassium, calcium, and gypsum, ammonium sulphate nitrate, and sodium ammonium sulphate gave average results about as good as those given by ammonium sulphate.

Studies on the best time and kind of application of nitrogenous fertilizers, especially lime nitrogen, using rye and sugar beets as crops, showed that fall fertilization of rye in the form of ammonium sulphate and lime nitrogen gave as good results on deep soil as spring fertilization. Late top-dressings with these fertilizers were unsuccessful. On the better deep soils ammonium salts and lime nitrogen gave the best results on grains when used in the fall, while on light soils the best results were obtained when the greater part of the nitrogen was applied as a top-dressing in the spring. It was further found that with sugar beets the best results were obtained when nitrogen in the form of sodium nitrate, ammonium sulphate, ammonium chlorid, or lime nitrogen was applied in its total amount before planting. Such a procedure gave a larger crop of beets with a higher sugar content than when the applications were divided. Fall fertilization of sugar beets seemed to be the best practice, especially with lime nitrogen.

In the phosphoric acid studies superphosphate, precipitated phosphate, Thomas meal, bone meal, and raw phosphate were tested. In only one case in six districts was there an important reaction to phosphoric acid fertilization. This occurred with sugar beets treated with slag. In most cases no reaction was observed, and no influence of the phosphoric acid fertilization was exerted on the sugar content.

In the potash studies kainit, 40 per cent potash salt, potassium chlorid, potassium sulphate, and potassium magnesium sulphate were tested on rye and potatoes. The kainit gave better results with rye than the 40 per cent potash salt or potassium chlorid. No mechanical injury to the soil resulted from the use of relatively large amounts of kainit. Potassium sulphate and potassium magnesium sulphate gave the best results with potatoes, closely followed by

the 40 per cent potash salt and potassium chlorid. A side application of keiserite to potassium chlorid did not increase the yield of either grain or potatoes.

A number of liming experiments are also summarized.

Where are there deficiencies in nitrogen and phosphoric acid? P. WAGNER (*Deut. Landw. Presse, 50 (1923), No. 3, pp. 21, 22*).—The results of experiments conducted in different parts of Germany are briefly reviewed, and these are taken to indicate that the German farmer has to-day absolutely no grounds for limiting nitrogen fertilization in the fear that the supply of phosphoric acid in the soil is insufficient to nourish crops satisfactorily, and that crops will not be capable of assimilating all the nitrogen applied without leaving a residue.

Nitrate (*U. S. House Represent., 67. Cong., 4. Sess., Com. Agr. Hearings on Nitrate, 1923, pp. III+124*).—The hearings before the Committee on Agriculture of the House of Representatives of the Sixty-Seventh Congress on the nitrate situation are presented in this publication.

Acid phosphate production by the Lipman process.—II, Building up sulphur-floats-soil mixtures with a high content of total and soluble phosphate, J. S. JOFFE (*Soil Sci., 15 (1923), No. 1, pp. 41–48, fig. 1*).—In a second contribution to the subject from the New Jersey Experiment Stations (E. S. R., 48, p. 822) experiments on the gradual additions of floats and sulphur in the proper proportions to dilute mixtures in order to build up the concentrated mixture and prevent the slowing down of the conversion of insoluble phosphates with increase in bulk of the floats in the sulphur-floats-soil mixtures are reported.

Significant phenomena noted were the rapid increase of the available phosphates as the H-ion concentration of the water extract increased, the large amount of sulphur oxidized, and the still greater increase of H-ion concentration after all the insoluble phosphates had been converted into soluble form. It was found that in the sulphur-floats-soil mixtures the amount of sulphuric acid formed at any moment was small, and that in the presence of large amounts of tricalcium phosphate there was no accumulation of acid.

The process of building up a concentrated compost resulted in the accumulation of phosphoric and sulphuric acids. It was also found that the inert material, greenhouse soil, was of importance in speeding up the activities of the sulphur-oxidizing organisms. The organic matter seemed to serve as a temporary storage place for the acid produced by the sulphur-oxidizing organisms, thus removing the sulphuric acid as fast as it is formed.

Cultures with an original high organic content showed a more efficient sulphur-oxidizing capacity. The best results as regards a high total concentration of phosphorus and as much available phosphorus as possible in the shortest period possible were obtained with a mixture passing through three stages, covering 24 weeks in all, including the preparation of the original culture. During this period it was possible to obtain a mixture containing 15 per cent of total phosphoric acid with 50 per cent of it soluble, and the results were accomplished in three stages of 7, 3.5, and 8 weeks.

Acid phosphate production by the Lipman process.—III, The use of greensand marl as the inert material in building up sulphur-floats mixtures, J. S. JOFFE (*Soil Sci., 15 (1923), No. 2, pp. 93–97*).—In a third contribution studies on the use of greensand marl as the inert material in building up sulphur-floats mixtures are reported, the purpose being to substitute some suitable material for the greenhouse soil usually used.

The results indicated that the insoluble phosphates in the marls are readily set free. The conclusion is drawn that greensand marl may well be used as

the inert material for the initial stage in the building up of these mixtures, with a small addition of soil rich in organic matter. The sulphur content should be increased in the initial stage, thus making possible a larger accumulation of acid. Simultaneously with the base mixture the second stage should be incubated, and the sulphur content of this mixture should also be increased. It is thought that this will appreciably cut down the time period in the second stage. Only at the third stage should floats be added alone in an amount necessary to take care of the excess of sulphur added in the initial and second stages.

Other suggestions are made, which have been covered in the previous papers of this series. It is the conviction of the author that with proper handling acid phosphate production by biological means may be accomplished on a practical basis.

Sulphur experiments, J. W. Ames (*Ohio Sta. Mo. Bul., 8 (1923), No. 5–6, pp. 85–90*).—A brief summary of the results of studies, begun in 1912, on the effects of sulphur and sulphates on the growth and composition of different crops is presented, some of which were reported in Bulletin 292 of the station (E. S. R., 35, p. 220). Particular attention was given to the influence of sulphur compounds on limed and unlimed soils and when used with different fertilizers.

The results indicated that, while the yields for different crops did not consistently show increases where sulphur and sulphates were applied, the addition of sulphur as sulphates or as elemental sulphur was to some extent favorable for clover and soy beans. The response of the several crops to phosphorus showed that that element was more essential than sulphur on the experimental soil. Oxidation of sulphur decreased the basicity of the soil, but not enough to render the soil too acid for soy beans.

Oxidation of sulphur by microorganisms in black alkali soils, S. A. Waksman, C. H. Wark, J. Joffe, and R. L. Starkey (*Jour. Agr. Research [U. S.], 24 (1923), No. 4, pp. 297–305*).—In studies conducted at the New Jersey Experiment Stations, the use of sulphur in the presence of the proper sulphur-oxidizing bacteria was found to result in the transformation of black alkali soil to white alkali soil. The final reaction of the soil depended upon the quantity of sulphur used and the length of time which the sulphur was in contact with the soil.

The oxidation of sulphur in black alkali soil is considered to be probably carried on by the agency of more than one sulphur-oxidizing bacterium. The speed of the reaction was greatly hastened in the presence of two bacteria, one of which could act upon sulphur under distinctly alkaline conditions, while the other rapidly oxidized sulphur under acid conditions.

AGRICULTURAL BOTANY.

Bacteriology, H. W. and H. J. Conn (*Baltimore: Williams & Wilkins Co., 1923, pp. 441, figs. 48*).—This textbook, which is designed primarily for college classes in first-year bacteriology, treats of general bacteriology and its applications both to medicine and to agriculture. The main parts into which the volume is divided deal, respectively, with general bacteriology, nonpathogenic organisms, and pathogenic organisms. A considerable portion of the first part is devoted to an historical introduction to the subject. The second part consists of sections on microorganisms in the dairy industry, microorganisms in relation to the fertility of the soil, and bacteria in relation to miscellaneous industries. The third part deals with human and animal diseases, bacteriology of water and sewage, and bacteria in relation to plant diseases. An

appendix contains brief sections on media making, characterizations of bacteria, and the reaction of media and H-ion concentration.

Grouping legume nodule bacteria (*Wisconsin Sta. Bul. 352 (1923), pp. 76, 77*).—By applying the agglutination test to nodule-forming bacteria, E. B. Fred and J. W. Stevens found that the bacteria could readily be separated into various strains. Tests are reported of 41 strains of legume bacteria, and they were found to fall into a far greater number of divisions than it was possible to recognize by inoculation tests.

Protein synthesis by Azotobacter, O. W. HUNTER (*Jour. Agr. Research [U. S.], 24 (1923), No. 3, pp. 263–274*).—Reports are given of experiments at the Kansas Experiment Station on protein synthesis by Azotobacter grown in aerated cultures, dextrose, molasses, and straw being used as sources of energy. The protein content of Azotobacter obtained from a solid medium was found to be 11.81 per cent, while that collected from liquid culture was 30.56 per cent. The yield of cells increased with the quantity of dextrose in the medium. When molasses was used as a source of energy, there was obtained a yield of cells equal to 30.44 per cent of the sugar in the molasses.

The author claims Azotobacter is able to convert the soluble nitrogenous substances present in molasses into more complex protein, as well as to utilize the molasses as a source of energy for the fixation of atmospheric nitrogen.

The addition of straw to the dextrose or molasses medium did not cause any appreciable increase in the quantity of nitrogen fixed.

Transpiration in Hevea brasiliensis, W. BOBILIOFF (*Arch. Rubbercult. Nederland. Indië, 4 (1920), No. 10, pp. 498–533, figs. 5*).—The hydathodes which abound on the lower sides of *H. brasiliensis* leaves give off water at night or vapor in considerable quantities under direct solar illumination. This process is, however, depressed by rising air temperature. Alterations in air humidity cause slight inverse variations in transpiration. Wind velocity shows an important direct influence on that process. Wetting of the leaves causes, first, absorption of water (particularly through the lower surfaces), and, secondly, pronounced transpiration from leaves on their drying after being wet.

Transpiration rate corresponds to increase or decrease of aperture in the stomata, and this in turn directly to illumination or inversely to closure incident to leaf fall.

It appears from the facts established that transpiration is an important factor influencing yield and explaining its variations, as, for example, high yield in the morning, low yield during strong wind, and decrease in yield during the period of leaf change.

On the stone cell ring in the cortex of Hevea, J. GANDRUP (*Arch. Rubbercult. Nederland. Indië, 5 (1921), No. 9, pp. 465–474, figs. 9*).—An investigation of the origin and growth of the stone cell ring in the bast of Hevea trees shows that during an early stage this ring is represented by bundles of prosenchymatic cells formed just inside the amylum cell sheath of the pericycle. Later these bundles coalesce, forming a continuous ring in the bast. Still later the cell walls become thicker by secondary growth, reducing the cell room to almost zero, thus forming a ring of ordinary bast fibers.

At a later stage this ring is broken following the increasing girth of the young shoot, and then the openings do not become closed by means of new fibers but by stone (sclerenchymatous) cells.

Cross sections have been made through a young plant at 11 points, with intervals of about 15 cm., and it is stated that the ring of fibers is gradually replaced by a ring of stone cells just in the place where the ring of fibers had originated. Further investigations are planned.

Influence of wheat seedlings upon the H-ion concentration of nutrient solutions, L. H. JONES and J. W. SHIVE (*Bot. Gaz., 73 (1922), No. 5, pp. 391–400*).—It is the aim of this paper to report briefly an experiment carried out for the purpose of comparing the various nutrient solutions commonly used for plant cultures with respect to the initial H-ion concentrations of the solutions, and to study the reaction changes induced in them by contact with the roots of young wheat plants. The indications of the tabular data obtained are discussed.

Cultivation of excised root tips and stem tips under sterile conditions, W. J. ROBBINS (*Bot. Gaz., 73 (1922), No. 5, pp. 376–390, figs. 4*).—A simple method of growing the isolated meristematic tissue of higher plants, excised root tips and stem tips, under sterile conditions is described.

It is shown that the excised root tips of peas, corn, and cotton make considerable growth in the dark in solution cultures containing mineral salts and glucose or levulose. The excised root tips of peas, corn, and cotton make little growth in the dark in solution cultures containing mineral salts and lacking carbohydrate. The growth of the isolated root tips of peas, corn, and cotton is markedly greater in solution cultures containing glucose than in those containing levulose. The excised roots of corn respond normally to gravity when grown on agar containing mineral salts and glucose. The isolated shoot tips of peas and corn make considerable growth in the dark in sterile solution cultures containing mineral salts and glucose or levulose, but little in the absence of carbohydrates. The excised shoot tips of corn and peas grown in sugar solutions remain chlorotic, and those of peas show the stem elongation and small leaf development characteristic of plants grown in the dark. When the excised root tips of corn are grown for 10 days or two weeks in the dark in a solution culture containing glucose and mineral salts, and the tip is then cut off and transferred to a fresh solution of the same type, the amount of growth in the second period is less than that in the first, and ceases in the third period.

Effect of autolized yeast and peptone on growth of excised corn root tips in the dark, W. J. ROBBINS (*Bot. Gaz., 74 (1922), No. 1, pp. 59–79, figs. 8*).—Causes suggested for the cessation of growth of the excised root tips of corn in the experiments above noted include an unbalanced condition of the nutrient solution, a deficiency of oxygen, and incompleteness of the nutrient solution, that is, the lack of some constituent necessary for continued growth. A consideration of the conditions of the experiments and the results obtained suggested that the third possibility should be used as a working hypothesis as the basis for further experimentation, which is here outlined.

Corn roots attached to the grain grow much more rapidly under sterile conditions in the dark in the Pfeffer solution plus 2 per cent glucose than do root tips detached from the grain.

When excised root tips of corn are grown under sterile conditions for about two weeks in the dark in Pfeffer solution plus 2 per cent glucose, and their root tips are severed and transferred to fresh solutions at intervals, it is found that growth stops in the third period. The addition of peptone or autolized yeast permits the root tips to grow for four to six periods. A concentration of 200 parts per million of gelatin, 100 of creatinin, 79 of glycocoll, 50 of asparagin, or the corn embryo extract used showed no beneficial effect. In the Pfeffer solution lacking nitrates and containing 2 per cent glucose a little less total growth was made than in the Pfeffer solution containing nitrates and 2 per cent glucose. Approximately 400 parts per million of peptone was more efficient than 200 parts, and autolized yeast was more beneficial than peptone. The beneficial effect of the autolized yeast does not appear in the

first period of growth, and concentrations of 10, 40, 80, 200, 400, and 800 parts per million of autolized yeast (equivalent in dry matter to about one-third the concentrations given) show no marked difference in their beneficial effect, especially in the early periods. The higher concentrations of yeast evidence a somewhat greater beneficial effect in the later periods than the lower concentrations.

When the total growth of excised corn root tips whose tips are cut off and transferred twice in a six weeks' period is compared with that of root tips left undisturbed, then in Pfeffer solution plus 2 per cent glucose in the dark the total growth in length and production of secondary roots is less and the dry weight is greater. In Pfeffer solution plus 2 per cent glucose and 400 parts per million of autolized yeast there is no difference in the growth in length or secondary root production and the dry weight is greater.

When the growth of excised root tips left undisturbed for six weeks in Pfeffer solution plus 2 per cent glucose is compared with the growth in the same solution to which 400 parts per million of autolized yeast is added, there is no difference in total length. The secondary root production is somewhat less and the dry weight somewhat greater. Excised corn root tips act as individuals. The growth of the secondary roots of an excised root is much greater when the primary root tip stops growth than when it continues to grow normally.

Magnesia injury of plants grown in nutrient solutions, W. F. GERICKE (*Bot. Gaz., 74 (1922), No. 1, pp. 110–113*).—Recent experimentation by the author appears to bear on the question of the so-called magnesia injury to cereals, and certain phases and data are herein briefly presented. No reference is made to the literature, this feature being reserved for inclusion in a later and more detailed account.

Effect of sodium chlorid and calcium chlorid upon growth and composition of young orange trees, H. S. REED and A. R. C. HAAS (*California Sta. Tech. Paper 4 (1923), pp. 21, pls. 6*).—The results are given of a study of the chemical and physiological aspects of the effect of sodium chlorid and calcium salts upon absorption by orange trees. Young trees were grown for 16 months in sand cultures under carefully controlled conditions, various culture solutions being supplied to them. It was found that culture solutions which were distinctly acid when freshly prepared became more nearly neutral after being in contact with tree roots in sand. The young orange trees a few months after the application of the modified culture solutions began to show physiological disturbances, which became increasingly severe.

The lack of calcium resulted in severe losses of leaves from the trees, and shortly before their fall the leaves were covered with small brown spots. Following the abscission of leaves new ones were frequently chlorotic. The repeated stopping and starting of new growth led to a condition known as multiple buds. The young shoot tips lost their turgor and died, and ultimately the trunk began to die, beginning at the top. The root system of such trees was poorly developed. In the presence of suitable amounts of calcium chlorid the trees made vigorous growth, even though they received considerable amounts of sodium chlorid.

An increase in the concentration of chlorin in the culture solution was followed by an increase in the percentage of this constituent in corresponding parts of the trees. The percentage of calcium in the ash of the different parts of the trees which were grown in full nutrient solution was fairly constant. When calcium was lacking from the culture solution the ash of the leaves, shoots, and rootlets contained very small percentages of calcium in comparison with the ash of trunks and roots. A slightly greater absorption of magnesium

was found to occur when calcium was absent from the culture solution. When the trees received calcium in their culture solution the percentage of potassium in the ash of all portions except trunks and roots was somewhat lower than when calcium was absent from the solution.

Inheritance of fruit shape in Cucurbita pepo, I, E. W. SINNOTT (*Bot. Gaz., 74 (1922), No. 1, pp. 95–103, figs. 3*).—Despite recent progress in the study of inheritance of quantitative characters, much less is known regarding size character interrelationships as determining shape. The present paper is a preliminary report of studies during recent years dealing with phases of shape inheritance in the summer squash.

A considerable variety of types of fruits of *C. pepo* was obtained, and an attempt was made by persistent self-fertilization to establish from this highly heterogeneous material types essentially pure. The 25 plants which set seed (self-fertile) were inbred for six generations, approximating purity by 1919 and giving an F_2 generation in 1921 from crosses made from the selected stocks.

In crosses between a type with approximately spherical fruits and three different races having "scallop" or "disk" fruits the disk shape showed complete dominance in the F_1 in every case, and in the F_2 there was a sharp segregation into three-quarters disk fruits and one-quarter sphere. A single, large, dominant flattening factor thus seems to distinguish these disk types from the spherical ones. In two of these crosses the extracted spheres are distinctly flatter than the pure types and the extracted disks distinctly deeper than the pure disks. This can be explained by assuming the operation in each case of a second flattening factor, also dominant, but showing a much smaller effect than the first. Evidence is brought forward that shape-determining factors actually exist and that the facts here set forth are not due merely to the segregation of size factors.

Development of plant communities of a sand ridge region in Michigan, W. G. WATERMAN (*Bot. Gaz., 74 (1922), No. 1, pp. 1–31, figs. 12*).—The region here discussed is located in Benzie County, Mich. This account includes numerout definitions of terms deemed appropriate to the factors and other units dealt with in such a typical (contemporaneous or successional) development of the plant communities as here outlined.

FIELD CROPS.

[Report of field crops work in Wisconsin, 1921–22] (*Wisconsin Sta. Bul. 352 (1923), pp. 28, 29, 40–46, 47, 48, 50–52, figs. 4*).—Experiments with field crops are reported as heretofore (E. S. R., 47, p. 430).

Outstanding among emergency hay crops tested by G. B. Mortimer, with suggested acre rates of seeding, were oats 1.5 bu., with field peas 1.5 bu.; Sudan grass 10 lbs., with soy beans 1.5 to 2 bu.; Sudan grass 20 to 25 lbs.; and soy beans 1.5 bu. Trials by H. W. Albertz gave indications that seedings of red clover on winter grains can be secured when alternate freezing and thawing of the ground occurs in spring, while timothy may be seeded any time after December 15, provided no snow is on the ground at seeding. Kudzu was not found to be a success in the State.

Varieties brought forward by B. D. Leith include Manchu soy beans, "cold resistant" Golden Glow corn, and White Cross oats. Among those developed by E. J. Delwiche are Forward oats, M. 1611 (a strain of Early Java spring wheat resistant to stem rust), Bacska winter wheat, and Hustler, Alcross, and Double Alaska canning peas. Observations at Marshfield by Delwiche indicate that the variety used as seed is one of the primary factors concerned in the lodging of oats. Wisconsin Wonder showed practically no lodging in the plats. White

Russian was second with 5 per cent of lodging, while many varieties lodged to the extent of 50 to 75 per cent. Seeding rates of 4, 8, 12, and 16 pk. per acre showed 0, 10, 10, and 30 per cent of lodging, respectively, with the lighter rates giving the lower yields.

Continued work with sunflowers for silage by E. D. Holden showed yields to be fairly uniform regardless of the planting distance between 6 and 20 in. However, the ratio of stalks to leaves in the silage increases as the space between the plants in the row becomes less. Planting sunflowers 8 to 12 in. apart in the row was found to produce the most satisfactory results.

Breeding of improved varieties of sweet corn for the canning industry was continued by E. W. Lindstrom and Holden, and by inbreeding, several new types of hereditary defective kernels were isolated. The analysis of self-pollinated selections for high and low alkaloid (atropin) content of the jimson weed (*Datura stramonium*) and the F_1 of hybrids of the high and low testing strains showed that high and low selection lines remained separate so far as the production of the alkaloid was concerned.

Rutabagas outyielded mangels at the several branch stations, and their cost of production was less both per ton and per acre.

The Ferramington variety of hemp grown for fiber matured fully two weeks earlier than fields of Kentucky seed, in comparisons by A. H. Wright. Though the height of the plants was a little less than that of the Kentucky varieties, they were tall enough to make very satisfactory straw. A combination of potash and phosphorus gave the best results with hemp on a nonacid marsh soil producing plants from 7 to 8.5 ft. high, while plants on untreated and potash plats averaged less than 2 ft. in height.

Control methods are outlined for Australian field cress (*Radicula palustris*), Canada thistle, quack grass, and white campion.

Varietal and cultural tests of field crops, F. B. Headley and E. W. Knight (*U. S. Dept. Agr., Dept. Circ. 267 (1923), pp. 6–12, fig. 1*).—Varieties of merit at the Newlands, Nev., Experiment Farm (E. S. R., 44, p. 432) included Early Amber sorgo and broomcorn; proso and Japanese millet; Wimples Yellow Dent, Oregon White Dent, and Riverview Special corn; and Producer, Netted Burbank, and Early Freeman potatoes.

The net yields from whole seed potatoes did not greatly exceed those from cut seed. Large tubers again gave heavier yields than medium or small tubers. Consistent yield differences were not apparent with seed dropped at 12-, 18-, and 24-in. intervals.

Corn alternating with wheat and manured before planting averaged 4.5 tons during 4 years, as compared with 3.8 tons from unmanured corn. The wheat produced 21.3 and 17 bu., respectively, and, contrariwise to the corn, showed a gradual decline in yield.

A seeding method for pastures is outlined and a mixture indicated. Dairy cows alternating every two weeks between grass and sweet-clover pasture produced as much milk on the sweet clover as on the grasses.

[Alfalfa investigations in Wisconsin] (*Wisconsin Sta. Bul. 352 (1923), pp. 29–40, figs. 7*).—Extensive investigations by L. F. Graber and numerous cooperative trials in the State demonstrated that an abundance of lime in the soil, inoculation, good surface and underdrainage, a reasonable degree of fertility, a firm, well-prepared seed bed, and the use of early ripening or early removed nurse crops are essential for success with alfalfa.

Cutting trials at the station farm by E. J. Kraus, Graber, and N. T. Nelson have given evidence that early cutting weakens alfalfa, induces yellowing, reduces the stand, increases weeds, and lowers yields. The effect of too frequent cut-

ting of alfalfa was seen where plats cut twice in the full bloom stage maintained a thrifty weed-free growth and yielded 4.3 tons per acre, while 3 early bud cuttings reduced the vigor, thinned the stand, and yielded only 3 tons of hay per acre, and the 4-cutting treatment when plants were from 4 to 8 in. high made only 1.1 tons of hay and practically eliminated the stand. Varieties cut 3 times in the bud and $\frac{1}{10}$ bloom stages have averaged 2.5 and 3.2 tons, respectively, whereas cutting twice in full bloom gave 4 tons. Cutting in full bloom also fits better into the cropping system and permits better curing of the hay. Plats in the pod stage cut twice annually for 2 years showed no injury to the stand or vigor of the plants, indicating that cutting off young crown shoots is not injurious.

The effect of scarification on the longevity of alfalfa seed has been noted (E. S. R., 49, p. 130).

Lack of snow is held responsible for heavy losses of alfalfa through winterkilling. In tests by Graber and Nelson with plants from 4 to 16 months old the common variety was winterkilled to a much greater extent than the Grimm or Turkestan, and when exposed to low temperatures the younger plants seemed to suffer less than the older ones. When the injury of an ice sheet of a month's duration was added to that of low temperatures, winterkilling was very severe, reaching 100 per cent with common alfalfa and over 82 per cent with the hardy Grimm variety. Heavy fall rains and late fall cuttings are considered as additional factors responsible for winterkilling. New seedings were shown to be much hardier than old stands in this respect.

Examination of 1,600 plants from 5 to 8 years old, by Graber and Nelson, to determine the cause of the disappearance of a fairly healthy growth and good stand in the early spring, revealed that 334 of the plants had live green crown sprouts, the roots were all healthy and firm, but one-third of the crowns were decayed and soft, and the others were partially injured and rotted. During warm weather, which normally would stimulate growth, the injured crowns or portions of the crown dried up and the sprouts soon died. Apparently the buds and shoots are more hardy than either the crown or the root of the plant, and the crown and upper portions of the root, which are more directly exposed to climatic conditions, suffer first from winter injury. A similar condition was observed in fields of alsike and red clover that had suffered in like manner from winter injury.

Fertilizer experiments with barley, LEMMERMANN (*Allg. Brau. u. Hopfen Ztg., 62 (1922), Nos. 87, pp. 393–395; 88–89, pp. 397–399*).—Experiments reported include studies of the effects of different soil types and fertilizers on the yields and quality of several barley varieties, comparisons of different salts on the yields and quality of the grain, and observations on the value of stable manure and green manure for the carbon dioxid fertilization of barley.

Thirty kg. per hectare (26.7 lbs. per acre) of nitrogen in the form of ammonium sulphate produced proportionately better yields after potatoes than 60 kg. Although the protein content was not altered by the 30-kg. application, increases of from 0.6 to 1 per cent were secured with 60 kg. The starch content was not affected by the nitrogen. Where peas instead of potatoes preceded barley, the nitrogen fertilizer was noticeably less effective, but the protein content of the kernels was 1.08 per cent higher, and the starch content was somewhat greater than without nitrogen fertilization.

Yields were increased in all cases by potassium fertilizers, with the chlorin-free salts less effective than those containing chlorin. Increasing the potassium application beyond the normal amount did not result in enhanced yields. While a definite effect of potassium fertilizers on the protein content of barley

was not observed, the protein was generally depressed and the grain consequently better for malting purposes.

Heritable characters of maize.—IX, Crinkly leaf, R. A. EMERSON (*Jour. Heredity, 12 (1921), No. 6, pp. 267–270, figs. 3*).—Crinkly, a semidwarf type of corn plant with crinkled leaves and relatively short and compact tassels which sometimes bear numerous seeds, occurred in the F_3 of a cross between dent and flint corn strains. The leaves are not only crinkled but often have prominent lobes near the base of the blades. These leaf characteristics vary, however, and separation of crinkly from normal plants is occasionally somewhat difficult.

The behavior of crosses, back crosses, and selfed crinkly plants indicates that crinkly is a simple Mendelian recessive to normal and that the two types are differentiated by the single factor pair *Cr cr*. That the expression of the character crinkly may be influenced by modifying factors seems likely, however, in view of the noticeable differences in height of plants and in breadth, crinkliness, and lobing of leaves in different stocks.

Earlier numbers of this series were noted (E. S. R., 47, p. 326).

Heritable characters of maize.—X, Zebra striped leaves, M. DEMEREC (*Jour. Heredity, 12 (1921), No. 9, pp. 406, 407, fig. 1*).—Zebra striped leaves were first observed in F_2 families resulting from a cross between pop corns. Transverse stripes made up of numerous yellowish dots appear on the leaves of corn in the young plant stage and become more pronounced in later stages of development by the enlargement and coalescence of these dots. While the genetical tests were not complete enough for final factorial analysis, zebra striping appears to be a Mendelian character and recessive to green.

Heritable characters of maize.—XI, Fine-streaked leaves, E. G. ANDERSON (*Jour. Heredity, 13 (1922), No. 2, pp. 91, 92, figs. 2*).—Fine-streaked corn leaves are characterized by a few narrow light streaks, although occasional plants are found in which the streaks are more frequent and more prominent. Fine-streak was first observed in cultures free from yellow endosperm. The character, fine-streak, seems to be dependent upon a factor closely linked with the factor pair *Y y* for yellow v. white endosperm, as no streaked plants were produced from yellow seed.

Heritable characters of maize.—XII, Mealy endosperm, P. C. MANGELSDORF (*Jour. Heredity, 13 (1922), No. 8, pp. 359–365, figs. 4*).—Mealy endosperm, a type of defective seed in which the corneous portion of the endosperm is partially or completely lacking, was found to be a simple Mendelian recessive. The genetic factor for mealy does not appear to inhibit specifically the formation of corneous endosperm, but simply to arrest the development of the growing seed at a certain stage. Mealy endosperm acts as a lethal factor, since mealy seeds will not grow under ordinary field conditions, and when planted in the greenhouse the few seedlings produced are very small and weak as compared to the normal, and live only a short time. Linkage with chlorophyll deficiency is indicated.

Some suggestions on potato culture, J. B. KEIL (*Ohio Sta. Mo. Bul., 8 (1923), No. 5–6, pp. 66–72, figs 3*).—Varieties, fertilizer and cultivation practices, seed selection, and rotations are recommended for potato growing under Ohio conditions.

The temperature of the rice seed bed, M. KONDÔ (*Nôgaku Kwaihô [Jour. Sci. Agr. Soc. (Japan)], No. 223 (1921), pp. 237–276; abs. in Japan. Jour. Bot., 1 (1922), No. 1, p. (7)*).—Experiments to determine the optimum temperatures for germination and growth in rice seed beds are summarized.

In order to maintain warm temperatures continuously, especially in cool regions or in spring, the seed bed must be covered with water up to 6 cm. (2.3 in.) in depth. With a very shallow covering (0.3 cm.) or where the soil is only saturated, soil temperatures in the bed are much reduced and, notably in cool regions, germination is very weak and growth decidedly slow. In warmer regions or seasons shallow irrigation is indicated, as the greater depths inhibit germination and growth. In southern Japan, the seed bed is often only saturated and, after seeding, is covered with river sand, soil compost, or charred rice hulls, resulting in lower temperatures. The temperature of the upper layer (1 cm.) on which germination and growth are dependent, varies with the weather and time of day, whereas the lower depths (10, 20, and 30 cm.) vary little in comparison. The ratio between atmospheric temperature and that of the seed bed varies greatly with the season and time of day. The temperatures of the seed bed and the water layer do not remain in a constant relation.

Seed bed studies with rice, M. Kondô (*Nôgaku Kwaihô [Jour. Sci. Agr. Soc. (Japan)], No. 240 (1922), pp. 791–862; abs. in Japan. Jour. Bot., 1 (1923), No. 3, pp. (38)–(40)*).—Where the 3-cm. irrigation customarily applied to rice seed beds in Japan was employed in experiments by the author, the plumules were long and thin and grew faster than with lighter applications, where the plumules remained shorter and yet thicker. The radicles, on the contrary, grew slower and remained short with plentiful water, and grew quickly and long with the lighter applications. Under cool conditions the radicle develops good only in deep water.

The custom of irrigating by day and draining by night is considered aimless and often even injurious. Covering the seed bed with sand, earth compost, or charred rice hulls impaired germination and seedling growth. When beds are deeply covered with water, particularly in warm periods and regions, the seedlings often rise to the surface. The practice of draining the bed daily from 9 a. m. to 3 p. m. for some time reduced the proportion of seedlings rising to the surface.

On land with even moderate salt content, it is considered important to keep the bed saturated and covered with charred rice hulls. Heavy applications of water are emphasized for land with high salt content, and, where possible, the bed should be drained from time to time and fresh water applied.

Natural hybrids in lowland rice, I. Suzuta and T. Tomuba (*Landw. Mitt. Formosa, No. 184 (1922), pp. 1–27; abs. in Japan. Jour. Bot., 1 (1923), No. 3, p. (47)*).—Observations on a number of varieties of lowland rice cultivated in Taiwan are summarized. In about 81, 78, and 29 per cent, respectively, of the plants in three of the plats noted, anther opening and pollen liberation accompanied the opening of the glumes with consequent self-pollination. In the plats with 29 per cent of coincidence, the anthers in 55 per cent of the individuals began to burst 10 seconds after the glumes opened. These data are cited to indicate the probability of occasional open or foreign pollination.

Plantings of a strain characterized by a purple coloring of leaf veins and auricles, upper sections of nodes and stigmas, made under various conditions of adjacency to a variety from green to white in color, resulted in from 0.9 to 1.45 per cent of hybrids. It was noted that the percentage of vicinists increased as the plants were closer together. Where these strains were planted parallel 0.47 per cent of hybrids were found in the leeward plat and only 0.086 per cent in the windward.

Experiments in the curing and fermentation of Connecticut shade tobacco, 1922, G. H. Chapman (*Connecticut State Sta., Tobacco Substa., Bul. 3 (1923), pp. 41–53, figs. 2*).—Curing and fermentation experiments were

carried on, in cooperation with the Connecticut Valley Tobacco Improvement Association, in 1922. A Carrier ejector processing cabinet was used for control curing of the leaf.

Study of the influence of plant maturity or time of harvesting on color, quality, etc., of 2A (fourth-seventh leaves, inclusive) priming Shade Cuban tobacco, with uniform curing conditions, gave indications that Shade Cuban tobacco harvested slightly green will yield a higher percentage of top grades than tobacco picked very green or ripe to overripe. With growing conditions approximating those of 1922 the second picking should be taken from 51 to 61 days after setting in the field. A comparison of control curing with barn curing of similar second priming Shade Cuban substantiated the foregoing conclusions, and showed that with control curing, aside from production of a higher percentage of desirable grades, the time during which tobacco can be picked and still yield very large quantities of top grades is at least three times as long as with barn curing. Data secured make it seem possible to produce light colored tobacco if third priming Shade Cuban tobacco can be subjected to proper temperatures and humidities in a correct relation in control curing.

A comparison of bulk-fermented with control-fermented tobacco showed the evening and setting of the colors by both methods to be satisfactory, but the elasticity and water-retaining capacity of the bulk-fermented was far superior to that of the control-fermented lots. The taste of the latter was bitter, while that of the bulk fermented was sweet and wholesome. Residual green coloring matter was present in comparatively large amounts in the control-fermented but had almost disappeared from the bulk-fermented tobacco. The amount of brown coloring matter was much less in the control fermented than in the bulk fermented. Control fermentation in the cabinet seemed to affect more the leaf surface, and evidently did not extend to the body of the leaf to any great degree. Analysis of leaves after fermentation showed that the protein was not reduced more than half as much in the control-fermented as in the bulk-fermented tobacco.

Classification of American wheat varieties, J. A. Clark, J. H. Martin, and C. R. Ball (*U. S. Dept. Agr. Bul. 1074 (1922), pp. 238, pls. 60, figs. 76*).—A practical system of classification of the wheat varieties grown in the United States, standardizing the varietal nomenclature and enabling growers to identify varieties with which they are concerned. Previous foreign and American classifications are reviewed and summarized.

The description, the known history, the distribution in the United States, and the synonymy are given for each variety. The names used for the recognized varieties are the original names or the name now most commonly used, or are the new or simplified names, as provided for by the code of nomenclature (E. S. R., 39, p. 389). All other names used for the varieties described are considered synonyms.

The keys and descriptions used to distinguish and identify varieties are based on characters which show considerable variation, including the plant characters, habit of growth, time of maturity, tillering, and height; the stem characters, color and strength; the leaf characters; the spike characters, awns, shape, density, and position; the glume characters, covering, color, length, width, and tenacity; the shoulder characters, width and shape; the beak characters, width, shape, and length; the awn characters, color and length; the kernel characters, color, length, texture, and shape; the germ characters; the crease characters, width and depth; the cheek characters; and the brush characters, size and length. The leading physiological characters considered

are productivity, milling and bread-making values, resistance to low temperatures, and resistance to diseases. Names of varieties which were reported but not grown or identified by the authors are listed. Estimates of actual and percentage acreages of wheat varieties grown in the several States in 1919 are tabulated. A bibliography of 206 titles is included, with an index to varieties and synonyms.

Some experiments with spring wheat in South Dakota, A. N. HUME and A. T. EVANS (*South Dakota Sta. Bul. 201 (1923), pp. 517–559*).—Varietal and cultural experiments with spring wheat are reported, supplementing earlier work (E. S. R., 30, p. 738). Notes on diseases and their control are included.

Durum wheat has averaged 25 per cent higher in yields than common wheat in the State, and it is held that under these conditions the price of common wheat must be over 25 per cent more than that of durum in order to be as profitable to the grower. Kota wheat (E. S. R., 48, p. 532) yielded somewhat higher than Marquis in short-time trials at Brookings and Highmore, and Marquis yielded higher in similar tests at Eureka. The respective average yields of Kubanka and Preston at Eureka, 12.8 and 7.7 bu. per acre for the period 1909–1915, and 15.1 and 9.1 bu. for the succeeding 7 years, are cited to indicate that varieties do not run out.

Date of seeding tests at Highmore suggest for highest yields seeding about March 15. A 7-pk. rate gave best yields of both common and durum at Brookings, and is recommended for both types in the Highmore area. Available data indicate that seeding should be deep enough to furnish a suitable seed bed. Wheat made its highest averages when following corn in rotations and its lowest yields under continuous cropping.

Winter wheat in South Dakota, A. T. EVANS and G. JANSSEN (*South Dakota Sta. Bul. 200 (1922), pp. 487–516, fig. 1*).—Varietal and cultural tests and rotations including winter wheat, carried on at Brookings, Highmore, Eureka, and Cottonwood, are summarized. The acreage and total production of winter wheat in the State in 1921 declined to about half that of 1916. While the crop is successful south of a line through Brookings and Huron, the type of winter weather probably determines its success north of this region. Experimental findings seem to indicate that winter wheat may be excluded from the Eureka area.

Selections of Turkey, Kanred, and Kharkof excelled in the varietal trials. Rate of seeding tests suggest a 6-pk. rate at Brookings, 6 pk. at Highmore with straw mulch and 5 pk. unmulched, and 5 pk. at Cottonwood and Eureka. September 2–3 seemed to be the best date of seeding on corn stubble cut high, September 14–18 on summer fallow, and probably not later than September on annual legume ground at Highmore. Plats mulched with rotten manure at Highmore have averaged 12.2 bu. per acre, while plats without mulch made 9.1 bu. A 2-ton straw mulch gave better results than 3 tons, with a 2-pk. rate of seeding with the 2 tons yielding nearly as much as 6 pk. with the 3-ton mulch.

Wheat at Brookings in a rotation of corn, wheat, oats, and legume has averaged 18.4 bu. per acre, and 12.7 bu. in a rotation of corn, oats, wheat, and legume. Yields from winter wheat in various rotations at Highmore suggest that protection must be provided for the crop. During 10 years wheat after corn has averaged 10.95 bu. per acre, while that on summer fallow made 8.4 bu.

Vegetative planting, L. CARRIER (*Bul. Green Sect. U. S. Golf Assoc., 3 (1923), No. 4, pp. 102–113, figs. 9*).—The vegetative method of planting creeping bent grass is described, with special instructions for planting putting greens.

Results of seed and legume inoculant inspection, 1922, J. G. FISKE (*New Jersey Stas. Bul. 377 (1923), pp. 5–73*).—The purity and germination are tabulated for 1,323 samples of agricultural seed tested during the year ended

June 30, 1922. Tables show the crops and inoculation power, organisms per package and per acre, and viability guaranties for about 45 official samples of legume inoculants.

HORTICULTURE.

Greenhouse soil sterilization (*Indiana Sta. Bul. 266 (1922), pp. 27, figs. 11*).—This bulletin, dealing with the installation and effectiveness of an underground tile system installed in a station greenhouse, is prepared in three parts:

I. *Sterilization methods and pest control*, H. D. Brown (pp. 3–19).—This discusses soil sterilization in general and describes the system utilized in the investigation, its installation, operation, and effectiveness in controlling nematodes and other greenhouse pests. In view of the fact that the entire house may be sterilized at one time by this system, much of the danger of accidental reinfection from untreated areas is avoided. Records of soil and air temperatures taken during sterilization operations indicated the feasibility of maintaining a uniform soil temperature of 140° F. or above over a period of hours. The covering of soil with heavy paper apparently assisted in the maintaining of soil temperatures at a higher level. No deleterious effect was noted on the boilers or on the structural work of the greenhouse. Nematodes were effectively controlled.

II. *Bacteriological and chemical examination*, I. L. Baldwin (pp. 19–23).—The results of examining soil samples taken before, during, and after the sterilization operation are dealt with. Sterilization greatly reduced the number of bacteria, apparently killing all vegetative forms. As a result nonspore-forming bacteria such as those producing nitrates and nitrites were destroyed. Other forms of bacteria increased rapidly after sterilization, causing disturbances in the equilibrium between species. Total water-soluble nitrogen was slightly increased by sterilization. A reduction in nitrate and an increase in nitrite content following sterilization are believed to be due to the reduction of one form to the other under the conditions of intense heat and insufficient oxygen. A consistent increase in acid-soluble phosphorus was recorded.

III. *Excess soluble salts in greenhouse soils*, S. D. Conner (pp. 23–27).—It is pointed out that the lack of exposure of greenhouse soils to rain and the constant watering with well water containing soluble salts may often lead to an accumulation of salts sufficient to injure plant growth. Steam sterilization, tending to render additional salts soluble, may suddenly increase their total to a decidedly injurious point. It is recommended that in greenhouses provided with good underdrainage this excess of salts be removed by thoroughly drenching the soil with water. Since valuable nitrates will leach out at the same time, it may be necessary to add manure or fertilizers to the beds following this treatment.

Tests of horticultural crops, F. B. Headley and E. W. Knight (*U. S. Dept. Agr., Dept. Circ. 267 (1923), pp. 12–16, figs. 3*).—Of six varieties of tomatoes grown in 1921 on the Newlands, Nev., Experimental Farm, Earliana and Burbank were the only ones to attain profitable maturity before frosts. Of eight cabbage varieties under test, Ideal Winter, Copenhagen Market, and Danish Ballhead produced the largest heads. Phenological data taken over a period of 6 years on apple trees showed that early blooming, because of frost injury to the flowers, is correlated with low production. As an improvement on cottonwoods and Carolina poplars for home adornment and protection, it is recommended that more desirable and useful species, such as black locust, Chinese poplar, Chinese elm, etc., be utilized.

A study of deciduous fruit tree rootstocks with special reference to their identification, M. J. HEPPNER (*California Sta. Tech. Paper 6 (1923), pp. 25, pls. 6*).—Morphological and histological studies of the roots of several important Pyrus and Prunus stocks used in California indicated that many of the species possess minute anatomical peculiarities sufficiently characteristic to serve as means of identification. Marked similarity was found between the roots of species whose above ground characters are very distinct. Pyrus roots were readily distinguished from Prunus roots by the greater number of cells in width of the medullary rays, 1 to 3 for Pyrus and 1 to 10 for Prunus. In cross section the tracheae of Pyrus exhibited an angular and irregular wall, while those of Prunus were more or less circular in outline, and their walls were quite smooth and continuous. Heartwood and sapwood of Pyrus consists largely of wood parenchyma, while that of Prunus is composed almost entirely of wood fibers.

Two distinct groups were found in Prunus, one comprising the apricot, Davidiana peach, common peach, almond, and Myrobalan plum and the other embracing Mazzard and Mahaleb cherries. Quince roots were practically identical morphologically and histologically with those of the other Pyrus species. Except in the apricot, wherein a beet-red color of the roots was definite enough to allow for positive identification, color was not sufficient to serve as a means of separation. Almond roots were distinguished by the character of the lenticels, which rarely extended more than $\frac{1}{16}$ in. above the bark surface, were few in number, very smooth, and had very distinct slits. The Davidiana peach, although identical with the common peach in external features, was anatomically distinct, having its tracheae grouped, while those of the common peach were arranged singly. The Mahaleb and Mazzard cherries, also identical in outward appearance, were histologically different, the lumina of the wood fibers of Mahaleb being characteristically small, while those of Mazzard were relatively large. Furthermore, the cortex of the Mazzard roots was found very bitter and astringent, a flavor sufficiently strong to serve as a reliable means of separating the two species.

Much greater difficulty was encountered in finding distinguishing characters in Pyrus species. *P. malus* possessed large, loosely fitting cells in the cortex, as compared with closely compacted cells in other species. It is believed that *P. serotina* and *P. communis* may be separated by a study of the tracheae in cross section in the spring wood of each year, those of *P. serotina* being elongated radially and only slightly angular walled, while those of *P. communis* were more nearly isodiametric and distinctly angular walled. *P. serotina* and *P. calleryana* were distinguished with extreme difficulty, the only possible distinction being in the lesser number of tracheae in *P. calleryana*.

Results of some experiments in pruning fruit trees, W. H. CHANDLER (*New York Cornell Sta. Bul. 415 (1923), pp. 5–75, figs. 15*).—A preliminary report upon a series of investigations dealing with the effect of various types of pruning upon young deciduous fruit trees.

The removal in June of the lower shoots from 1-year-old Delicious apple trees pruned to whip form resulted in a marked decrease in the weight of tops and of roots of the treated trees as compared with corresponding weights taken on check trees. The fact that the length of twigs on the unpruned part of treated trees was considerably less than that of the corresponding part of untreated trees leads the author to suggest that the lower leaves in some way exerted an influence on upper growth. Weights of roots and tops, including prunings recorded one year after the pruning of Delicious trees unpruned since the time of grafting and 2 years old at the time of treatment, showed the following re-

sults: Unpruned 892.5 gm., lower branches removed up to 2 ft. 725.2 gm., and lower branches removed and top branches headed in one-half 619.6 gm. Leaf area, as measured in the fall of the year of treatment, was also sharply reduced by pruning. Quite similar results were secured with 4-year-old Elberta and Early Crawford peach trees, except that root growth was reduced more than top growth, a fact believed by the author to be due to reduction in carbohydrate formation following pruning and the greater utilization in the presence of superabundant water and nitrogen supply of the existing carbohydrates in th branches, with consequent inadequate supply of these materials for the roots. Early Richmond cherry trees, 2 years old at the beginning of the experiment in 1917, were pruned back severely each year. When dug in 1922 and compared with unpruned trees, it was found that pruning had materially decreased weights, both green and dry, of the various parts of the tree. Not only was the total leaf area considerably reduced by pruning, but a given leaf area produced some 7 per cent less dry matter on pruned than on unpruned trees. From these studies the author concludes that any kind of pruning in a young orchard tends to be a dwarfing process, despite temporary invigorating influences sometimes observed.

The relation of pruning to fruit bearing was studied in apple and pear trees planted in 1911, plums planted in 1912, and cherries in 1914. On account of the poor fertility of the soil, nitrate of soda was supplied to the trees during the years 1917–1921. Trees of some of the varieties were seriously injured by the severe winter of 1917–18. Of the several pruning systems included in the experiments, only two, one consisting of very slight pruning and the other known as the modified open head, are considered. Records, presented in tabular form, show that in nearly all varieties, irrespective of species, the heavier pruning had reduced the total amount of fruit produced, especially in late-bearing varieties. Trunk circumferences were not strikingly different in the two types of pruning. Measurements of leaf area of spur and twig leaves upon lightly and heavily pruned trees showed a general tendency for the spur leaf area to be smaller on the more severely pruned trees, with twig leaf areas nearly equal. A comparison between average number of fruits and average percentage of increase in trunk circumference for individual trees showed that fruiting reduced the growth of trees, sometimes to a greater extent than would have occurred following severe pruning.

A study of the effect of time of pruning on young Northern Spy trees indicated that summer pruning dwarfed the trees more than did equally severe dormant pruning. Records taken during the initial 10-year period upon apple, pear, and plum trees, part of which were pruned in summer and part while dormant, showed that summer pruning had no stimulating effect on fruiting and tended to reduce production. The occurrence of a severe winter following the severe heading back of 4-year-old Baldwin and Stayman apple trees on October 21 and November 21, 1919, resulted in the death of a large number of trees, especially those pruned in November. Trees pruned on March 23 suffered only slight losses, indicating that severe autumn pruning had reduced the resistance of trees to severe cold.

In studies bearing on general pruning practices it was found that the leaves of vigorous top shoots of Bosc pear trees were apparently more effective in elaborating food than were those of the lower branches, producing nearly twice as much dry weight per unit area. The removal of excess buds from the trunks of young peach trees resulted in a smaller leaf surface during the summer than that of untreated trees. However, when the untreated trees were pruned the following season they failed to attain as large size as did the

trees disbudded the first year. The removal of lower secondary branches from Wealthy and McIntosh trees greatly reduced their leaf areas. The opening of the heads of young apple trees, accompanied by the thinning out of lower branches, greatly reduced yield and did not materially improve the quality of fruits. The severe cutting back of one branch upon young Stayman trees resulted in much greater dwarfing when the rest of the branches were left untouched than when the entire tree was pruned. The cutting back of young Elberta peach trees greatly reduced the size of the first crop of fruit.

In concluding, the author presents general suggestions based on the investigations reported and upon extended observation.

The apple tree crotch: Histological studies and practical considerations, L. H. MacDaniels (*New York Cornell Sta. Bul. 419 (1923), pp. 22, pls. 2, figs. 14*).—In an effort to determine the fundamental reason for crotch weakness in apple trees, resulting often in the breaking down of important limbs on fruiting trees, the author made a careful study of the different types of crotches, including microscopic and macroscopic examination of the woody tissue and the submission of various types of crotches to breaking tests.

It was found that one of the most important factors in relation to strength of crotch is the width of the crotch angle. In general, the more acute the angle the weaker the union. Observation upon trees of several varieties indicated that the type of angle is largely a varietal character. For example, the McIntosh tree usually forms wide angles and strong unions, whereas Northern Spy develops narrow angles and weak unions.

Mechanical tests conducted with 26 crotches showed a gradual increase in resistance to breaking correlated with increase in the width of the angle. In addition it was found that the relative size of the two branches of the crotch bears a very important relation to strength. Crotches with equal sized arms split apart much more readily than those with unequal arms. The origin of more than two scaffold limbs at nearly the same point on the trunk leads to weakness, in that the crowded condition prevents the wood of the main trunk from partly surrounding and supporting the side branches.

Histologically, crotch tissue differs from normal tissue in possessing more parenchyma, larger medullary rays, and fewer wood fibers and vessels, and is lacking in orderly arrangement. There is a more or less definite line of cleavage between the tissue of the two branches of a crotch, and the lines of conduction for the two limbs are separate and distinct.

Chemical analysis showed that tissue of the bark and wood of a crotch has a higher nitrogen content than corresponding tissue of the remainder of the tree, a fact which is believed to account in part for the greater susceptibility of the crotch tissue to winter injury.

Practical suggestions are given for the pruning of young trees so as to avoid acute and dangerous crotches and for the bracing of the limbs of older trees which may not have been properly pruned when young or which have been weakened by winter injury.

The modified leader tree, R. H. Roberts (*Wisconsin Sta. Bul. 354 (1923), pp. 3–32, figs. 33*).—Through the media of photographs, drawings, and discussion, the author outlines a method of apple tree pruning designated as the modified leader, which he deems to be better than the central leader or open center types and to combine the best qualities of both. In pruning the tree according to this system the central leader is not removed but is suppressed by heading in so that it becomes only slightly longer than the lateral branches. One-year-old nursery trees are recommended for orchard planting, in that they

are more conformable to shaping and generally make a more satisfactory initial growth than do older trees. Pruning operations during the first two or three years after setting are deemed to be particularly important in developing the modified leader tree, in that the permanent branches are best selected at this time.

Studies in the nutrition of the strawberry: Nutrition as related to yield. V. R. GARDNER (*Missouri Sta. Research Bul. 57 (1923), pp. 3–31, fig. 1*).—Working with Dunlap strawberry plants rooted, while yet attached to the mother plant, in pots containing sand and productive sandy loam, the author found that the nutritive conditions under which the young plants developed had an enduring effect on their ultimate productivity, irrespective of the nutrients supplied just prior to active fruiting.

Examination made on September 22, three weeks after lifting the rooted runners, showed that, despite similar outward appearance, the plants in the two soil media were radically different. Those from the fertile soil were considerably heavier and contained higher percentages of total carbohydrates and of starch. The repeated defoliation of plants of each series during September and October caused the death of some members of the sand-grown group, indicating that the removal of leaves not only curtailed the manufacture of food but forced the use of that already conserved. Determinations showed that defoliation reduced total fresh and dry weight, slowed down starch and total carbohydrate accumulation, and in case of the sand-grown plants reduced the percentage of starch.

When brought into the greenhouse in February, the soil-grown, undefoliated lot developed the largest and most vigorous growth, with defoliated soil-grown, undefoliated sand, and defoliated sand lots following in order. Not only were twice as many flowers produced by the undefoliated soil-grown plants as by the comparable lot of sand-grown plants, but also the berries averaged nearly twice as large. Defoliation reduced the average number of flower clusters and flowers per plant, but had very little influence on the size of berries. It slightly increased the percentage of sterile flowers in the sand-grown plants. The quality of soil had no influence on the season of maturity.

The spring application of liquid manure to plants of the different lots increased in the case of the sand-grown plants and decreased in the case of the soil-grown plants the number of flower clusters, number of flowers, and yield of fruit. It is believed that liquid manure aided the sand plants in developing flowers which, though differentiated, would not have developed without additional food. The addition of nutrients to soil-grown plants, on the other hand, appeared to suppress buds already formed. No significant effect was observed on the size of berries.

Counts of the total number of pistils and of the percentages thereof developing into akenes in Gandy blossoms showed that the earliest maturing fruits, invariably the largest, possessed the largest percentage of normally maturing pistils. In addition it was observed that the earliest appearing flowers had the largest number of pistils, indicating that size of berry is correlated with the number and the successful setting of the pistils in the individual flowers. The removal of the first opening blossoms from the clusters led to the setting of blooms which otherwise would have failed. However, the resulting fruits were smaller, due to the lesser number of pistils per blossom.

Determinations of the sex of the plants growing in the different soils showed that of 93 plants grown in pure sand 91 had changed their normal sexual condition, that of hermaphroditism, and were producing purely pistillate blooms. That this phenomenon originated during the fall and winter months was evi-

denced by the fact that the liberal spring fertilization had no influence whatever on sex of blossoms. Apparently low carbohydrate and starch content at time of flower bud differentiation led to the production of pistillate blossoms in a variety normally perfect flowered. It is believed that variations in the relative carbohydrate content are responsible for changes in sex, low carbohydrates being associated with female, high with male, and intermediate with perfect or hermaphroditic condition. As a practical deduction from the investigation, the author points out that strawberry beds should receive greater care during the fall months, a period in which beds are very often seriously neglected. In this period are largely determined the number of flower clusters which will develop and the number of flowers that each cluster will bear, and, furthermore, due to the influence of the number of pistils upon the size of the berries, the ultimate percentage of culls.

Establishing a commercial vineyard in Arizona, F. J. Crider (*Arizona Sta. Bul. 96 (1923), pp. 46, figs. 30*).—This is a compilation of general information relative to grape production in Arizona, a State which, because of its irregular contour, is adapted to growing both the vinifera and labrusca types of grapes. The various phases of grape culture, including selection of varieties, propagation, establishment of vineyards, pruning systems, culture, irrigation, etc., are discussed. Numerous illustrations are included to assist in explaining practices.

The pruning of citrus trees in California, R. W. Hodgson (*California Sta. Bul. 363 (1923), pp. 487–532, figs. 20*).—A general discussion prepared in two parts, the first of which deals with the general principles of pruning, while the second presents information relating to the various phases of pruning orange, lemon, and grapefruit trees. Among the subjects considered in the second part are reasons for pruning, complicating factors, and the pruning of young, bearing, and neglected trees.

The acid lime fruit in Hawaii, W. T. Pope (*Hawaii Sta. Bul. 49 (1923), pp. 11+20, pls. 6*).—This is a compilation of general information relating to varieties, culture, insects and fungus pests and their control, and chemical composition of fruit for commercial and home uses. Analyses of five varieties of limes growing at the station are included.

Arbor Day (*U. S. Dept. Agr., Dept. Circ. 265 (1923), pp. 15, figs. 8*).—This circular is designed to supersede Circular 8 (E. S. R., 42, p. 141).

FORESTRY.

Natural reproduction of western yellow pine in the Southwest, G. A. Pearson (*U. S. Dept. Agr. Bul. 1105 (1923), pp. 144, pls. 24, figs. 14*).—This is a study of factors controlling natural reproduction of western yellow pine, in which, in addition to general notes, careful observations were taken on 29 sample plats located in the Coconino and Tusayan National Forests in northern Arizona. An exceptional seed crop in 1918 followed by abundant early summer rainfall in 1919 resulted in a large crop of seedlings, the occurrence of which afforded an unusual opportunity for studying the factors influencing their establishment. Of the numerous factors responsible for success or failure of reproduction, seed supply, climate, soil, herbaceous vegetation, cutting, brush disposal, grazing, fire, insects, and rodents are important items.

In respect to seed supply, the minimum seed requirement for the forests studied is placed at 8 lbs. per acre in good seed years, which occur at intervals of from 3 to 5 years. Three favorable seed crops are normally required to completely restock an area. A minimum per acre of four large sound trees having a

diameter of 20 in. or more is considered essential to successful seeding. Of the several elements which make up climate, described as the largest natural complex of factors affecting yellow-pine reproduction in the Southwest, moisture is considered the most important. In the average year more seedlings die during the drought of June and early July than are lost during all the remaining portion of the year. With respect to soils, it was found that those of a sandy, gravelly, or stony nature, irrespective of their geological origin, favored reproduction. The roots of young trees, apparently, were able to penetrate to greater depths in the coarser soils and were, therefore, better able to obtain moisture during drought. Clay soils tended to crust at the surface, thus interfering with germination. Herbaceous vegetation, although favoring germination and protecting young pine seedlings against excessive sunlight and winter injury, was found to injure older plants by excessive shading and root competition. Moderate grazing by horses and cattle is suggested as a logical means of controlling excessive growth of herbaceous plants.

In that old trees seriously interfere with reproduction within a considerable distance of their base and in that yellow pine is able to establish itself without the shelter of older trees, it is recommended that only such trees be conserved as are absolutely essential to proper seeding. Where partial reproduction is already in progress at time of cutting, the recommended number (four) of seed trees may be decreased.

Of the three methods of brush disposal practiced by the Forest Service in the Southwest, namely, piling and burning, scattering, and pulling tops, that of scattering, in which the brush is deposited in small dense patches separated by open spaces 2 or 3 ft. wide, apparently best favored reproduction, except on bunch grass lands, where piling and burning is recommended. Where advanced reproduction exists at the time of cutting, piling and burning should be the invariable practice, since unburned brush not only constitutes a fire hazard but may also smother many of the smaller plants. The overstocking of potential forest areas with horses, cattle, and sheep causes serious injury to young pines. Under conditions of abundant pasture, horse and cattle grazing may benefit reproduction by suppressing excessive growth of grass and herbs. Sheep, however, browsing as they do on yellow-pine seedlings, constitute a positive menace to reproduction, and should be kept off of seedling areas until most of the trees are 3 ft. in height. Disease, insects, and small animals, although enemies of reproduction and causing considerable losses in the aggregate, as a rule are not sufficiently important to be seriously considered.

In concluding, practical suggestions are embodied for encouraging natural reproduction of western yellow pine.

Preliminary yield tables for second-growth redwood, D. Bruce (*California Sta. Bul. 361 (1923), pp. 425–467, figs. 5*).—Based on data obtained in 135 plats located in seven California counties, yield tables are presented for three redwood site classes. Site 1 is described as land which may ultimately be valuable for agriculture, while sites 2 and 3 are such as may be logically used for permanent redwood production. None of the stands considered in the investigation were over 60 years of age, and in no case were the poorest quality sites included. The grading of the various sites was largely accomplished by determining the age of the stand, measuring the height of the tallest tree in each of the several well defined clumps of sprouts, and computing the average.

The author calls attention to the remarkably rapid growth of redwood, attaining at 60 years on the best site a basal area of 486 sq. ft. and a volume of 20,200 cu. ft. per acre. Satisfactory growth also occurred on the poorer sites.

Rapidity of growth was also notable. On site 1 at 20 years an average redwood was 8 in. in diameter at breast height and 50 ft. high.

In comparing the relative heights of even aged trees in open and in dense stands, it was found from measurements on 28 plats that the average heights within fully stocked plats exceeded that of open stands by 13 per cent. An investigation of the effect of small sized plats on the accuracy of tables showed that plats less than 0.2 acre averaged 5 per cent above the tabular basal area. However, this departure from the average is not considered sufficiently large to be important. A very positive correlation was observed between heights of Douglas fir, white fir, and spruce growing as associated species with redwood, leading to the conclusion that the height of redwood may be deduced with reasonable accuracy from that of associated species, provided values for fir are reduced by 16 per cent and those for spruce by 20 per cent. It was found, however, that a decrease in the percentage of redwood in a mixed stand was accompanied by a decrease in the basal area of the plat until, if redwood was entirely lacking, the basal area declined to 76 per cent of that given in the table, which was based on stands approximately 84 per cent pure for redwood. It is believed that the presence of moderate proportions of associated species does not materially affect the volume nor the average diameter at breast height. The data upon which the tables are based are included in detailed tabular form.

Annual progress report on forest administration in the Province of Bihar and Orissa for the year 1921–22, E. R. Stevens (*Bihar and Orissa Forest Admin. Ann. Rpt., 1921–22, pp.* [*69*]).—The usual progress report on the constitution and management of the State forests of this Province, silvicultural operations, exploitation, financial results, research and experiments, etc. (E. S. R., 45, p. 239).

List of forest officers of the British Empire (*Empire Forestry Jour.* [*London*], *App. No. 1* (*1923*), *pp. 24*).

DISEASES OF PLANTS.

[Plant disease investigations at the Wisconsin Station] (*Wisconsin Sta. Bul. 352* (*1923*), *pp. 46, 53–65, figs.* 7).—Experiments of A. G. Johnson and E. D. Holden have shown the possibility of securing barley seed free from *Helminthosporium gramineum* by treating infected seed with a formaldehyde solution, planting at a time unfavorable for the development of the fungus, and not allowing diseased plants to mature to a point where they are discharging spores of the fungus.

A report is given of work by J. Johnson on wildfire of tobacco in Wisconsin. The disease, which is due to *Bacterium tabacum*, made its appearance in 1922 in several localities of Dane County. It is believed to have originated in seed beds, and by giving attention to their complete sterilization or by locating seed beds at some distance from tobacco fields and old beds the disease may be kept in check. Rotation of crops is said to be highly beneficial for the prevention of the root rot of tobacco.

In a study made by J. Johnson on the temperature relations of potato mosaic, it was found that temperatures of from 57 to 65° F. were favorable for the development of symptoms of mosaic, while the disease disappeared rapidly at temperatures of 77° or above. Under field conditions the disease is said to show up abundantly early in the season or after cool periods while the plants are young and rapidly growing. Attention is called to the importance of considering temperature conditions preceding inspection for certification of seed potatoes.

Continued studies of dwarf fruit trees by R. H. Roberts are said to have shown that the conditions of composition and vegetative growth of the trees have an important influence on pollen tube growth and fertilization of blossoms, fertilization being accomplished in 3 or 4 days less time on strongly growing trees than on weak ones. The difference is believed to be due to the relative amount of nitrogen stored in the trees.

G. W. Keitt and L. K. Jones have continued their spraying experiments for the control of apple scab, and while satisfactory control was secured with a 4–4–50 Bordeaux mixture, there was so much russeting of the fruit as to render its use inadvisable. The addition of adhesives to lime sulphur gave less satisfactory control than did applications of lime sulphur alone. Tests were made of dust treatments as substitutes for liquid sprays, with variable results.

The experiments of Keitt and Jones have shown that the addition of adhesives to fungicides failed to increase their efficiency for the control of cherry leaf spot. The best control was secured from 3 applications of a 3–3–50 Bordeaux mixture, the first spraying being made just after the petals had fallen, the second 2 weeks later, and the third after harvesting of the fruit.

Experiments carried on for three years are said to have shown that wheat scab affects wheat and corn seedlings only under conditions unfavorable to their growth. According to the experiments of J. G. Dickson, wheat blights at soil temperatures above 52° and corn usually at soil temperatures below 64°. Wheat seedlings grown at a low soil temperature are characterized as having a high content of available carbohydrates, low content of available nitrogen, and large amounts of available sugar that are rapidly converted into cellulose in the tissues, which makes for thickened cell walls and considerable resistance to the wheat scab organism. When the seedlings are grown under conditions of high soil temperature they have little or no available carbohydrates, the seedlings are high in nitrogen, there is no thickening of the cell walls by reserve material, and plants grown at high soil temperatures offer no resistance to the fungus.

Corn seedlings grown at a high soil temperature are comparable to wheat seedlings grown at low soil temperatures. They are high in available carbohydrates and low in available nitrogen, and some of the carbohydrate materials are laid down as cellulose. It is believed that the disease resistance and predisposition to disease, in this case at least, are largely dependent upon the environmental conditions under which the plant is grown and the resulting difference in the chemical composition of the host tissues.

Former investigations reported by J. C. Walker (E. S. R., 45, p. 244) showed that resistance to onion smudge (*Colletotrichum circinans*) was associated with the color of the bulb scales and presence of volatile oils in the onion cells. More recent work has shown that the pigments appear to contain a yellow nonglucosid, one or more yellow glucosids, a red nonglucosid, and one or more red glucosids. A yellow glucosid or a mixture of glucosids has been crystallized from both the red and yellow onions, and in the case of the yellow onions this mixture was found to be toxic to the fungus.

Investigations of M. N. Walker and S. P. Doolittle are said to have shown that cucumber mosaic is carried over winter on the common pokeweed and that it may be transmitted to the pigweed and the cultivated ground cherry. The common occurrence of these host plants is said to make the control of the disease in cucumber fields quite difficult.

Experiments have been in progress for a number of years at the station to secure strains of cabbage resistant to yellows, and as a result of recent field trials made by L. R. Jones and E. C. Tims the development of a kraut type of

cabbage resistant to yellows is announced. Resistant varieties of other types of cabbage have been reported previously.

A study was made by A. J. Riker of the crown gall disease with reference to the relations of the organism to its host plants. Inoculation experiments on tomato showed that wounds are necessary for infection. The bacteria in every case observed were located between the cells.

Experiments by L. K. Jones for the control of anthracnose of black raspberries showed that two applications of lime sulphur controlled the disease for commercial purposes. The addition of an adhesive to the mixture seemed to increase the efficiency of the fungicide. In general, Bordeaux mixture was less effective, though two applications gave a satisfactory commercial control. A third application of either Bordeaux mixture or lime sulphur made a week after blooming of the plants was beneficial in reducing the amount of disease, but severe injury to the foliage followed.

Preliminary list of Manitoba fungi, G. R. Bisby and A. H. R. Buller (*Brit. Mycol. Soc. Trans., 8 (1922), pt. 1–2, pp. 91–109*).—This list of Manitoba fungi (though admittedly very incomplete, only a general preliminary survey having been made) contains a considerable number of fungi which are or may be of economic importance.

As regards the Myxomycetes, no parasitic forms have been found in Manitoba. Few parasitic or injurious bacterial forms have been found. None of the Phycomycetes appear to cause particular damage. The list of economic fungi, including smuts and rusts found without very special search, is rather extensive.

Report on the occurrence of fungus, bacterial, and allied diseases on crops in England and Wales for the years 1920–21, A. D. Cotton ([*Gt. Brit.*] *Min. Agr. and Fisheries, Misc. Pub. 38 (1922), pp. 104, pls. 2*).—This report, combining the data for the years 1920 and 1921, deals with diseases of economic plants as grouped under cereals, potatoes, roots, pulse, forage crops, vegetables, fruit, and miscellaneous (flax, hop, lavender, mushrooms, rhubarb, rose stocks, tobacco, and willow). To this are added weather charts for the period, with explanations, and a special index to diseases.

Report on plant diseases [Norway], 1920–21, I. Jørstad ([*Norway*] *Landbr. Direkt. Beret. Tillegg C, Beret. Skadeinsekt. og Plantesykd., 1920–1921, pp. C 79, figs. 24*).—This report deals with a number of diseases of different crops or vegetables, giving more particular attention to certain cereal, legume, tuber, and root crops. Potato wart (*Synchytrium endobioticum*) is mapped, with discussion, as existing at several points around or near Christiansand.

Dusting seed grain to prevent smut, E. C. Stakman and E. B. Lambert (*Minn. Agr. Ext. Spec. Bul. 70 (1923), pp. 12, fig. 1*).—The results are given of experiments carried on in 1921 and 1922 for the control of grain smuts by the use of copper carbonate and other fungicides.

Dusting seed wheat with copper carbonate has been found to prevent stinking smut, and it is preferable to formaldehyde, as it saves time and labor, the seed may be treated before planting, the seed does not become wet, and copper carbonate does not injure the seed, while it seems to have a tendency to stimulate germination, and thus increase yields. Experiments with oats show that oat smut also may be controlled by copper carbonate.

Experiments were made with two other chemical dusts, anhydrous copper sulphate and lime, and Seed-O-San. The copper sulphate and lime mixture was not found as satisfactory as copper carbonate, and while Seed-O-San stimulated germination more than copper carbonate it did not entirely prevent smut.

Chlorophol, a new fungicide, used in solution prevented smut and did not injure the seed in any of the tests.

The authors claim that smuts of oats and covered smut of wheat can be practically controlled by copper carbonate dust, and that it also may control the covered smut of barley, flag smut of rye, kernel smut of sorghum, and millet smuts. It will not control the loose or naked smuts of wheat and barley, timothy smut, corn smut, and head smuts of sorghum and timothy.

Preliminary note on the destruction of the cotton hair by microorganisms, H. J. DENHAM (*Brit. Cotton Indus. Research Assoc., Shirley Inst. Mem., 1 (1922), No. 8, pp. 143–150, figs. 44*).—Observations are outlined in this preliminary note which show that without becoming evident serious damage may be done by microorganisms and contributory causes operating upon cotton fibers under conditions other than ideal. Further studies are in progress on specific modes of degradation by definite organisms in pure culture, also on the whole question of the external relations of microorganisms which attack cotton fibers.

Cross-inoculation studies with cucurbit mosaic, S. P. DOOLITTLE and M. N. WALKER (*Science, 57 (1923), No. 1477, p. 477*).—In continuation of previous cross-inoculation studies (E. S. R., 44, p. 344) the authors report experiments in which they have successfully transferred cucurbit mosaic to 8 genera, 23 species, and 8 botanical and 96 horticultural varieties of plants. With the exception of the genus Citrullus, all of the cucurbits thus far inoculated have proved susceptible to mosaic.

Cross-inoculation studies with other families have shown that cucurbit mosaic was transmissible to Martynia, pepper, milkweed, and pokeweed, and further studies have shown that it is readily transmissible from these hosts back to the cucumber. It may also be transmitted from milkweed to Martynia and pepper and back to milkweed. The authors found that the most successful method of inoculation was through the transfer of aphids from mosaic plants, but successful results were obtained by artificial inoculation with crushed tissues or expressed juice.

It was found that cucumber mosaic was readily transmissible to tobacco through the pepper and vice versa, the pepper apparently acting as an intermediate host. In continuation of previous experiments the potato was found susceptible to cucumber mosaic, and a high percentage of infection of cucumbers was secured from potato plants which had earlier been inoculated with cucumber mosaic. In addition to other hosts, it has been found that cucumber mosaic may be transmitted to the pigweed (*Amaranthus retroflexus*) and to a cultivated ground cherry (*Physalis* sp.).

Identification of certain species of Fusarium isolated from potato tubers in Montana, H. E. MORRIS and G. B. NUTTING (*Jour. Agr. Research [U. S.], 24 (1923), No. 4, pp. 339–364, pls. 3*).—A record is given of taxonomic work carried on with about 100 cultures of Fusarium isolated from potato tubers between 1914 and 1918. No special effort was made to connect any of the species with an ascigeral stage, and in all the work nothing was observed to indicate the occurrence of such a stage. Nine species are technically described and four others tentatively determined but not described, as the authors had no authentic cultures with which to compare them.

Occurrence and significance of phloem necrosis in the Irish potato, E. F. ARTSCHWAGER (*Jour. Agr. Research [U. S.], 24 (1923), No. 3, pp. 237–246, pls. 5, figs. 3*).—From a study of normal potato plants and those affected with leaf roll and related diseases, the author found that the condition of the phloem and the absence of necrosis of other tissues offer diagnostic characters of great value in recognizing diseases of this type.

Common scab of potatoes, I, W. A. MILLARD (*Ann. Appl. Biol., 9 (1922), No. 2, pp. 156–164, pls. 2*).—In view of the general uncertainty as to the organ-

ism causing potato scab in Britain, the author carried out an investigation which has been made the subject of a preliminary report and has been noted (E. S. R., 46, p. 450). Credit is given in the present report for work done in this connection by K. Sampson.

From the experimentation briefly indicated confirmation is obtained of the correctness of the work of Thaxter (E. S. R., 3, p. 9). This work shows the applicability of the conclusions of that author to types of scab in Britain, also that scab may be produced by various members of the Actinomyces group exhibiting considerable differences in culture. To what extent these different members may be considered as belonging to a single species or species group is, however, a matter needing further investigation, which is being carried out.

Sugar cane chlorosis in Egypt, V. M. Mosséri (*Bul. Union Agr. Égypte, 19 (1921), No. 140, pp. 75–86, pls. 5*).—An account having local and more general bearings is given of sugar-cane chlorosis as regards symptoms, causation, and control measures.

Cultivated and wild hosts of sugar cane or grass mosaic, E. W. Brandes and P. J. Klaphaak (*Jour. Agr. Research [U. S.], 24 (1923), No. 3, pp. 247–262, pls. 4*).—Previous experiments by one of the authors (E. S. R., 42, p. 449) having shown that certain grasses were affected by the mosaic disease of sugar cane, an investigation was made to determine whether grasses in general were subject to this disease. Inoculations and infection by insects were made under controlled conditions, which show that 13 species of grasses were susceptible to the disease known as sugar-cane mosaic. Certain varieties of sugar cane belonging to the slender North India type, which were formerly regarded as immune, have been proved susceptible to mosaic. Data are presented to show that considerable injury is done to southern varieties of corn through the presence of this disease. Field observations are reported to indicate that natural infection of sorghum, pearl millet, crab grass (*Syntherisma sanguinalis*), bull grass (*Paspalum boscianum*), *Chaetochloa magna*, and *Brachiaria platyphylla* is widespread near affected cane in the sugar-cane belt. All attempts to secure transmission through seed gave negative results.

Tobacco wildfire and blackfire, C. A. Ludwig (*Clemson Agr. Col. S. C., Ext. Circ. 53 (1923), pp. 12, figs. 3*).—Popular descriptions are given of tobacco wildfire due to *Bacterium tabacum* and blackfire caused by *B. angulatum*. Suggestions are given for the control of both diseases.

Wildfire of tobacco in 1922, G. H. Chapman and J. P. Anderson (*Connecticut State Sta., Tobacco Substa. Bul. 2 (1923), pp. 7–38*).—This publication is a report of cooperative work with the Massachusetts Experiment Station, a bulletin of which, containing the same information, has already been noted (E. S. R., 48, p. 847.)

Condensed recommendations for the control of wildfire, E. H. Jenkins and G. H. Chapman (*Connecticut State Sta., Tobacco Substa. Bul. 1 (1922), pp. 4*).—Directions are given for seed, seed bed, and field control of the wildfire disease of tobacco.

Sleepy disease of the tomato, W. F. Bewley (*Ann. Appl. Biol., 9 (1922), No. 2, pp. 116–134, pls. 4*).—As the result of the present investigation, it is claimed to have been shown that the so-called tomato sleepy disease, described by Massee and by him ascribed to *Fusarium lycopersici* (E. S. R., 7, p. 222), is in reality (in Great Britain at least) two distinct diseases, caused, respectively, by *F. lycopersici* and *Verticillium alboatrum*, the latter being the cause of what Massee called the Diplocladium stage. The fungi attack the roots and grow up through the vascular bundles into the stem, leaves, and (sometimes) the fruits. The wood of a diseased plant is colored light or dark brown.

The average temperature is a limiting factor in determining which is the active fungus. *F. lycopersici* grows best at an average temperature of 27.8 to 28.9° C. (82 to 84° F.), little infection resulting if the temperature remains constantly much lower. *V. alboatrum* develops well at temperatures from 15.6 to 24°, being most active at 21.1 to 22.8°, little infection occurring at average temperatures above 25°.

The average temperature conditions existing in glasshouses in this country are usually too low for *F. lycopersici*, which consequently is rarely found to cause tomato wilt. The relatively low temperatures are favorable to *V. alboatrum*, which accordingly is the most important cause of wilt.

Wilted plants soon die under low temperature, but above 25° they recover and bear continuously.

V. alboatrum from tomato readily causes wilt in the potato, eggplant, snapdragon, cotton, pepper plant, and cucumber, and produces a stunted condition of the sycamore and elm.

Different strains of *V. alboatrum* have been isolated which vary in their rate of growth, the amount and rate of production of microsclerotia, and color production, but varietal strains were not established.

In pure culture the fungus produces numerous enzyms. Apparently toxins play an important part in producing wilt.

A distinct relation holds between hardness of growth and wilt susceptibility, the harder growing varieties and plants suffering from starvation or a severe check in the young stages being most susceptible to attack. Manx Marvel has proved to be practically immune and Bides Recruit highly resistant, though most varieties locally cultivated are susceptible to Verticillium.

Certain cultural devices, including temperature and shade regulation, have been found to assist wilted plants to recover. Further investigations upon soil sterilization and the production of resistant varieties are in progress.

A wilt disease of the sweet pea has occurred in certain commercial nurseries where this crop is grown in the early part of the year before a tomato crop. *V. alboatrum* was isolated and proved by inoculation results to be the cause of the disease.

A series of cross inoculations with *V. alboatrum* from the tomato, cucumber, and sweet pea upon tomatoes, cucumbers, and sweet peas was successful, causing in every case definite wilt. Examinations showed that the fungi from these host plants are identical.

A new fruit spot of apple, Brooks' spot, R. C. THOMAS (*Ohio. Sta. Mo. Bul., 8 (1923), Nos. 5–6, pp. 91–96, figs. 2*).—A description is given of a fruit spot of apples due to *Phoma pomi* (E. S. R., 20, p. 847), and suggestions are given for its control. Attention is called to other fruit spot diseases, and differences are pointed out. For the control of this disease the author recommends spraying with Bordeaux mixture or lime sulphur, and as the attack apparently is made during early and midsummer the spraying schedule should include applications early in June and also about the first of July.

Peach rosette, an infectious mosaic, J. A. MCCLINTOCK (*Jour. Agr. Research [U. S.], 24 (1923), No. 4, pp. 307–316, pls. 10*).—An account is given of investigations conducted at the Georgia Experiment Station, which are held to confirm previous findings that the rosette is readily transmitted from peach to peach by infected buds (E. S. R., 3, p. 485). The author reports having transmitted rosette to two varieties of apricots, two of cultivated plums, one wild plum, one cherry, and two varieties of almond by means of infected buds. On some hosts rosette was found to produce a mottling of leaves similar to mosaic. The Marianna plum was found immune to rosette. Limited experiments have indicated that rosette is not transmitted through the soil, and all

attempts to transmit the disease by means of sap or by the transfer of insects from infected trees gave negative results.

Leaf character in reverted black currants, A. H. Lees (*Ann. Appl. Biol., 9 (1922), No. 1, pp. 49–68, figs. 54*).—Owing to the absence of definite criteria characterizing the presence or absence of reversion in black currants, the author presents, with discussion, a method which was arrived at by careful comparison of normal with reverted leaves, and which is relied upon for the identification of reverted leaves even in very slight cases or cases of recovery approaching normality.

The method depends on counting the number of submain veins running from the midrib to points in the margin and on observation of the margin points, which may also, if necessary, be reduced to a numerical basis.

It is stated that a reversion of a temporary character may be produced by artificial means, apparently as the result of a special stimulus to growth.

Cases in the field were examined in detail in three respects, namely, leaf vein number, mite-infected buds, and leaf margin. Cases that could be distinguished were normal healthy, simple reverted, and mite infected (reverted). These corresponded with three factors indicated as seasonal factor, reversion factor, and mite factor. Since oak leaf is an advanced stage of reverted leaf and is always associated with mite, it is thought probable that reverted leaves when found without oak leaves owe their existence in some way or other to the mite factor either patently or latently.

The parasitism of Nectria cinnabarina (coral spot), with special reference to its action on red currant, J. Line (*Brit. Mycol. Soc. Trans., 8 (1922), pt. 1–2. pp. 22–28, pl. 1*).—A study is described as carried out during 1919–1921 on currant bushes bearing stromata of *N. cinnabarina* and showing a more or less sudden wilting as regards leaves and fruit. Apparently *N. cinnabarina* is not able ordinarily to enter healthy tissues, except after a period of time spent in a dead portion of the host. It can occasionally establish itself when introduced into a wound in woody plants, more readily in lime and horse-chestnut than in red currant. The normal manner of attacking red currant is by spreading through the healthy wood cells from a dead region. Its harmful action in the first place is due to the stoppage of the wood cells by the fungal hyphae, thus causing wilting and death of all parts above the point affected.

No differences in power of infection or in behavior in culture were observed between strains of the fungus isolated from different sources.

Grapevine apoplexy and its treatment, L. Moreau and E. Vinet (*Bul. Agr. Algérie, Tunisie, Maroc, 2. ser., 29 (1923), No. 1, pp. 5–7*).—The authors studied the sudden death of grape stocks, which subsequently show a yellow coloration and a punklike consistency.

The authors propose to substitute the name amadou for the name apoplexy applied to this form of attack, as this is regarded as the abrupt culmination of a trouble that may have persisted for some time previously. Tests made with commercial preparations of sodium arsenite show almost absolute control.

Gum diseases of citrus trees in California, H. S. Fawcett (*California Sta. Bul. 360 (1923), pp. 369–423, figs. 15*).—The author has brought together the available information regarding the so-called gumming diseases of citrus in California. Among the diseases described are brown rot gumming due to *Pythiacystis citrophthora*, mal di gómma or foot rot (*Phytophthora terrestria*), Botrytis gumming (*B. cinerea*), Sclerotinia gumming (*S. libertiana*), psorosis or scaly bark, Diplodia gumming, twig gumming, exanthema, and various minor forms of gumming.

Suggestions are given for the control of the various forms of gumming so far as definite means are known. Some of the more technical aspects of gumming diseases are mentioned below.

Gummosis of citrus, H. S. FAWCETT (*Jour. Agr. Research [U. S.], 24 (1923), No. 3, pp. 191–236, pls. 8*).—In this publication the author has given the results of an investigation into the nature, causes, and manner of development of certain types of gummosis of citrus trees. The principal part of the paper deals mainly with the causal relation of *Pythiacystis citrophthora* to citrus gummosis and the relation of another fungus, *Phytopthora terrestria*, to a similar disease in Florida. Other types of gummosis are described, and a discussion is given relative to gum formation, the conditions influencing its formation, and its relation to the disease.

The Pythiacystis gummosis is widespread in California and is characterized by copious exudations of gum and dead patches of bark on the trunk and main roots. The usual symptoms of the disease may be readily transmitted to healthy trees through inoculations with bits of bark tissue or cultures of the fungus. In the limited number of inoculation tests some indication was observed that *Fusarium* sp., found commonly in connection with Pythiacystis gumming lesions, increased the severity of the disease, but the Fusarium alone was not capable of initiating the gummosis. Differences in resistance to disease were noted, the sour orange being almost immune and the common lemon the most susceptible.

Mal di gomma due to *Phytophthora terrestria* is quite similar to certain phases of Pythiacystis gummosis, and inoculations with both organisms, under the same conditions, produced lesions which showed no characteristic differences.

Cutting out the bark invaded by organisms and the application of Bordeaux mixture or other fungicides is recommended for the control of these forms of gummosis.

The author reports a strain of *Botrytis cinerea* commonly associated with the gummosis of lemon trees. Pure cultures of the fungus, as well as bits of the diseased bark, were found capable of inducing the disease in healthy lemon trees if inoculated into injuries. By avoiding injuries to the bark and by using a fungicidal coating on its surface, the disease may be prevented.

Sclerotinia libertiana is said to be occasionally associated with rapid dying of bark and copious gum exudation on trunks and roots, particularly on lemon trees. Inoculation experiments carried on with a large number of other organisms showed that some of them were capable of gum formation, but only to a slight extent compared to those mentioned above.

The author claims that gum in citrus is similar to gum arabic and cherry gum, and it appears to originate mainly in the xylem tissue by hydrolysis of the cellulose walls. Injuries by certain insects may result in slight gum formation, but burning and freezing were not found important factors except that they opened the way for the introduction of parasitic fungi. Certain chemical substances were found to induce gummosis, although without the typical symptoms of diseases produced by the fungi.

The author claims that experiments with boiled and unboiled filtrates from healthy and diseased tissues indicate the presence of a heat-sensitive enzym.

Citrus blast and black pit, H. S. FAWCETT, W. T. HORNE, and A. F. CAMP (*California Sta. Tech. Paper 5 (1923), pp. 24, pls. 6*).—Black pit of lemons, first described in 1913 (E. S. R., 29, p. 650), and citrus blast, reported in 1916 (E. S. R., 37, p. 153), have been shown due to the same organism (E. S. R., 46, p. 244). In the present bulletin the results are given of investigations on

the nature of the disease, conditions for its development, and means for its control.

Black pit is said to be most commonly met with on lemons in southern California, and blast occurs most frequently on leaves and twigs of oranges and grapefruit in the northern parts of the State. The organism (*Pseudomonas citriputeale*) is said to be widely distributed throughout the citrus regions of the State.

The symptoms of the disease, development, and results of isolation and inoculation tests are described.

In addition to citrus trees the organism can be readily transferred to leaves and twigs of some of the California live oaks, among them *Quercus wislizenii* and *Q. agrifolia.*

All attempts to produce lesions on leaves, buds, and twigs of cherry, apricot, pear, and almond through the transfer of organisms proved failures. Injuries, low temperatures, and moisture were found important factors in the development of the disease.

For its control the authors recommend spraying with Bordeaux mixture as early as November 1, to be followed by a second spraying on or before December 15. The pruning of trees so as to force a bushy, compact type of growth and protection against injury by winds is recommended where it is practicable to provide these precautions. In southern California, where the disease is of minor importance, it is not believed that spraying will be advisable, but protection against injury due to winds should be advantageously provided.

The life of the mallow rust fungus in and upon its host plant, J. Eriksson (*K. Svenska Vetensk. Akad. Handl., 62 (1921), No. 5, pp. 190, figs. 31*).—A formal account (largely review with discussion of salient features) is given of the author's researches, extending through 1920, on mallow rust (*Puccinia malvacearum*) as regards its nature, changes, and relations, with list of contributions related thereto by himself and others.

Experiments on the field control of snapdragon rust, together with a description of a method for the control of the disease in greenhouses, O. Butler (*New Hampshire Sta. Tech. Bul. 22 (1923), pp. 3–14, figs. 2*).—Laboratory and field experiments of the author and others having shown that copper fungicides were of little value for the prevention of the germination of the spores of *Puccinia antirrhini,* attention was turned to sulphur and sulphids with the result that sulphur was found to inhibit the germination of the spores, and when applied under certain conditions of temperature it protected the plants in the field from rust. With modification this same treatment was found practicable for greenhouse use. The conditions necessary to obtain control of snapdragon rust by means of applications of sulphur are a temperature of 22° C. (71.6° F.) for from 11 to 12 hours during a majority of the days in each week in the period of growing prior to blooming. The addition of a heat-absorbing body such as soot does not increase the fungicidal value of sulphur.

The snapdragon rust can be successfully controlled in the greenhouse by sulphuring when the fungus fruits and by maintaining a temperature of 72° F. for from 11 to 12 hours daily during the fruiting season.

Studies in bacteriosis.—VI, Bacillus carotovorus as the cause of soft rot in cultivated violets, M. S. Lacey (*Ann. Appl. Biol., 9 (1922), No. 2, pp. 169, 170*).—A disease, which is described as of considerable importance, occurred in the early part of 1921 at the Hayden Violet Grounds, Stourpaine, England.

Careful comparison of the organism with the laboratory culture of *B. carotovorus* appears to prove the two organisms identical, the cultural and

physiological features agreeing very closely, so that the disease is ascribed to *B. carotovorus*.

Another wet rot, and Poria hypobrunnea, T. F. CHIPP (*Gardens' Bul. Straits Settlements, 2 (1921), No. 12, pp. 429–432*).—A fungus attacking *Spathodea campanulata* at Singapore is thought to be identical with *P. hypobrunnea*, which is supposed to have been present in Malaya for some years.

ECONOMIC ZOOLOGY—ENTOMOLOGY.

A biological survey of the Pribilof Islands, Alaska (*U. S. Dept. Agr., Bur. Biol. Survey, North Amer. Fauna No. 46 (1923), pp. IV+255, pls. 15*).—This report of a biological survey of the Pribilof Islands, which constitute a national reservation, is divided into two parts:

I. *Birds and mammals*, E. A. Preble and W. L. McAtee (pp. 1–128).—The introduction to this part (pp. 1–4) and a discussion of life zone relationships (pp. 5–9) are by Preble, followed by an account of birds, by Preble and McAtee (pp. 10–101), and an account of mammals (pp. 102–120) and a bibliography (pp. 121–128), by Preble.

II. *Insects, arachnids, and chilopods*, McAtee et al. (pp. 129–244).—This part consists of an introduction and accounts of Apterygota, Anoplura, and Heteroptera, by McAtee; an account of Orthoptera, by M. Hebard; Mallophaga, by G. F. Ferris; Homoptera, by E. M. Patch; accounts of Trichoptera, Mecoptera, and Arachnida, by N. Banks; an account of Lepidoptera, by W. T. M. Forbes; Coleoptera, by H. F. Wickham; Diptera (Tipulidae and Rhyphidae), by C. P. Alexander; Diptera (except Tipulidae, Rhyphidae, and Calliphoridae), by J. R. Malloch; Diptera (Calliphoridae), by W. R. Walton; Hymenoptera, by H. L. Viereck; and Chilopoda, by R. V. Chamberlin.

Report on bird censuses in the United States, 1916 to 1920, M. T. COOKE (*U. S. Dept. Agr. Bul. 1165 (1923), pp. 36, fig. 1*).—A discussion of the methods of taking bird censuses and the essentials of a satisfactory bird census is followed by accounts of the results of bird censuses north of Maryland and east of the Plains, from the Southeastern States and from the Western States, some notable bird-census results, the relative abundance of certain species, density of bird population, bird life on marshland, bird life on the woodland, scarcity of birds in 1918, and the response of birds to protection.

"Results of bird censuses for the five years 1916 to 1920, inclusive, show a very close agreement with those obtained in 1914 and 1915 for the section of the country lying north of Maryland and the Ohio River and east of the Great Plains—a little more than one pair of birds to the acre as the average for farm land. For the land immediately surrounding the buildings and including the lawns and orchard, on the average about 130 pairs of birds are found to nest on 100 acres; the estimated bird population of the entire farm is about 112 pairs to 100 acres. The counts made in the southeastern section of the country have been on tracts so scattered and of so small an acreage that no conclusions concerning the average bird population are yet possible." The same is true of counts on the Plains, and in the Rocky Mountain region and westward general averages would be practically impossible, even with many times the data now at hand.

"In small patches of woodland, especially when they are surrounded by cultivated fields, birds nest very abundantly, but in the deeper woods they are scarce. For the former, the average bird population is 182 pairs to 100 acres; but the estimate given of 68 pairs to 100 acres of the latter is probably rather high. Several counts made in the forests of the Rocky Mountain

region show about one pair of birds breeding on 2 acres, and it is probable that the same proportion holds in similar regions in the Eastern States."

[Entomological investigations of the Wisconsin Station] (*Wisconsin Sta. Bul. 352 (1923), pp. 65–74, figs. 6*).—In the work of wintering bees by V. G. Milum and H. F. Wilson, observations show that, "though the bees may be unable to keep on increasing the temperature of the inside sufficiently to resist the cold, the temperature on the outside of the cluster still remains at or near from 57 to 60° F. It appears certain that if the low temperature is maintained very long, the bees must become unable to resist it and eventually die. The conclusion from these observations is that it is necessary for bees to use up a great deal more energy when packed out of doors than is the case when they are packed in the cellar, and that increased amounts of packing around the bees necessarily kept out of doors helps them in keeping the cluster temperature at 57° with less energy and consequently gives them a better opportunity to survive the winter." The average winter losses for the entire State are from 15 to 20 per cent and sometimes run as high as 30 per cent of all the colonies.

In experiments, conducted by Wilson, with a view to discovering a satisfactory means of destroying the spores of *Bacillus larvæ*, the cause of American foulbrood, a specially prepared sodium hypochlorite was found to possess a solvent action on dead bees, pollen, cocoons, and other débris in the combs without injuring the wax. Living as well as dead larvæ in the cells were completely dissolved in 24 hours. An account of the experiment has been noted (E. S. R., 49, p. 156).

In spraying work with the potato leafhopper, C. L. Fluke found that an application of Bordeaux mixture increased the yield from 83.25 bu. per acre in an unsprayed area to 186.5 bu. in the plat sprayed with four applications of the 4–4–50 formula, applied July 7, 17, and 27 and August 5. A specially prepared spraying boom was used in making the applications, equipped with nozzles that thoroughly covered the underside of the leaves. Three nozzles were used to each row, arranged so that one sprayed down and two upward, one on each side of the row. From 75 to 100 gal. of spray were applied per acre, and an effort was made to keep the spraying pressure at 200 lbs.

In continuation of the previous year's experiments, cooperative work with nicotin sulphate in dust carriers was carried on by J. E. Dudley, jr. Exhaustive tests were made against eggs, larvae, or adults of the squash bug, Colorado potato beetle, potato flea-beetle, onion thrips, turnip aphid, melon aphid, and two species of cabbage worms, the details of which are briefly reported.

In work with the striped cucumber beetle, by Dudley, nicotin sulphate combined with hydrated lime, copper sulphate and lime, unslaked lime, gypsum, and sulphur were used with good success. An average of 75 per cent of the beetles were killed by hydrated lime containing 5 per cent nicotin sulphate. With a mixture containing 10 per cent of nicotin sulphate, 83 to 98 per cent, with an average of 91 per cent, of the beetles were killed. A mixture of nicotin sulphate and copper sulphate lime (uncombined Bordeaux) containing 10 per cent nicotin sulphate gave an average kill of 86 per cent. It was found that a rather inert carrier, such as hydrated lime or gypsum, was preferable to an active carrier, such as unslaked lime, because much nicotin is lost by volatilization when it is mixed with an active substance. Flight experiments made with over 35,000 beetles show that they had flown on an average about 0.5 mile each, so it seems probable that this insect seldom flies over that distance.

In control work with the pea aphid by Fluke and Dudley, the pest was found to be one of the aphids most resistant to nicotin fumes. The percentage killed

varied from 55 to 95, depending somewhat on the percentage of nicotin in the dust, the temperature, and the absence or presence of wind. In control work by Fluke, with grasshoppers, it was found that sawdust could be substituted for bran in the formula for poison bait. The formula which was used successfully consists of sawdust (hardwood preferred) 25 lbs., white arsenic 1.25 lbs., salt 1.25 lbs., amyl acetate 12 lbs., water enough to moisten (about 3 or 4 qt.), and middlings 5 lbs. The red-necked cane-borer (*Agrilus ruficollis*), one of the most troublesome insects in raspberry culture, was studied during the year by A. Weed.

Animal pests of the orchard, garden, and ornamentals and their control, K. H. C. JORDAN (*Die Tierischen Schädlinge des Gemüse-, Obst- und Blumen-Gartens und ihre Bekämpfung. Liepzig: Oskar Leiner, 1922, pp. XII+266, figs. 88*).—This is a popular handbook.

Truck-crop insect pests in the Virgin Islands and methods of combating them, C. E. WILSON (*Virgin Islands Sta. Bul. 4 (1923), pp. II+35, figs. 24*).—The insect enemies of truck crops in the Virgin Islands are described and control measures suggested.

Notes on some of our cocoa pests, W. H. PATTERSON (*Jour. Gold Coast Agr. and Com. Soc., 2 (1923), No. 2, pp. 95–102, pls. 5*).—Brief accounts are given of some of the important insect enemies of cacao in the Gold Coast.

The present status of dusting and spraying for citrus pests, W. W. YOTHERS (*Fla. Grower, 27 (1923), No. 21, pp. 6, 7, figs. 2*).—The author points out that at the present time practically all the spraying for the control of scale insects and white flies is done with emulsions made of cheap lubricating oil.

Dusting tall trees by airplane for leaf-eating insects, J. S. HOUSER (*Jour. Econ. Ent., 16 (1923), No. 3, pp. 241–249*).—In continuation of the work previously noted (E. S. R., 47, p. 851) two tests are reported upon. In one of these a 30-acre mixed woodland at Cleveland infested with cankerworm (*Anisopteryx* sp.) was treated, and in the other a 4-acre catalpa grove at Casstown, Ohio, infested with the catalpa sphinx was dusted with undiluted arsenate of lead. A satisfactory kill was obtained in both instances, and further data as to the best means of manipulating the machine, etc., were obtained.

Vacuum fumigation experiments with brown-tail moth and European corn borer larvae under winter conditions, R. I. SMITH (*Jour. Econ. Ent., 16 (1923), No. 3, pp. 317–321*).—"Fumigation of brown-tail moth (*Euproctis chrysorrhoea*) nests in midwinter show that brown-tail moth larvae were killed when fumigated at 50° F., and in many cases when the temperatures were as low as 39°. European corn borer larvae (*Pyrausta nubilalis*) taken from a storeroom at a temperature of 40 to 45° and fumigated in a temperature of 65 to 70° were not killed. Borers frequently counted as dead from 2 to 14 days after fumigation were found to recover and even complete their transformations. The experiments, with few exceptions, represented 2-hour fumigation periods, much better results being obtained when the time was extended to from 6 to 10 hours."

Bordeaux mixture as a control for leafhoppers, F. A. FENTON and J. H. TRUNDY (*Jour. Econ. Ent., 16 (1923), No. 3, pp. 314–317*).—The author's tests indicate that Bordeaux mixture is a specific insecticide for at least one and possibly four species of leafhoppers, namely, the apple leafhopper, grape leafhopper, *Empoa rosae* L., and *Erythroneura tricincta* Fitch.

The chinch bug, H. C. SEVERIN (*South Dakota Sta. Bul. 202 (1923), pp. 561–576, figs. 2*).—A practical summary of information on the chinch bug, with control measures.

The immunity of apple stocks from attacks of woolly aphis (Eriosoma lanigera Haus.), I, L. N. Staniland (*Jour. Pomol. and Hort. Sci., 3 (1923), No. 2, pp. 85–95*).—This first part of the paper on the subject deals with the relative resistance of different rootstocks. The result of definite infestations of the types of apple stocks in commercial use in England with woolly aphid have shown that complete immunity is very rare, and that a high degree of resistance of root and branch is also rare. None of the true types of so-called Paradise are immune to woolly aphid, though there are very marked differences in degrees of resistance both above and below ground.

"Amongst indiscriminate seedling 'free' stocks there are similar degrees of resistance, but the character of immunity appears to be very rare. Amongst Wilding 'crabs' of particular types, preliminary investigations seem to show that immunes are to be found, though many 'Wildings' also appear highly susceptible. . . . Northern Spy under English conditions is immune both root and branch; Winter Majetin, which has so far only been tested for branch susceptibility, is immune also.

"The same degree of root and branch resistance, however, does not always go together. The degree of resistance to attack is about equal above and below ground in eight cases. In six cases the resistance is greater below ground than above, and in two vice versa. A stem immune plant, in the case of Majetin, has been shown capable of retaining its immunity though worked on a susceptible root (Doucin Ameliore type V). How far this is of general application is being tested further.

"There seems no obvious connection between either vigor and dwarfingness or fibrous roots and coarse roots and susceptibility and immunity to woolly aphis. Above ground wound tissue, young wood, and water shoots are most easily infected. Such points as these have not yet been decided with regard to the roots."

Gallicole phylloxera and the protection of grapevines, H. Faes and M. Staehelin (*Ann. Agr. Suisse, 23 (1922), No. 4, pp. 295–303, fig. 1*).—The procedure for disinfection of the roots of the grape for the winter eggs of phylloxera recommended by the Federal Viticultural Station of Lausanne consists in submergence for 12 hours in a 3 per cent solution of potassium sulphocarbonate at 32° B. and 1 per cent of black soap.

Mealybugs on the roots and nodules of legumes growing in the field, L. T. Leonard (*Science, 57 (1923), No. 1484, pp. 671, 672*).—The author records the finding of the mealybug *Pseudococcus maritimus* (Ehrh.) living upon the nodules of leguminous plants, including the soy bean, navy bean, Japan clover, and chickpea, as many as 15 mealybugs having been observed on one soy bean nodule. The position in which they were generally found indicated a preference for nodules on all except red clover, where they were found in the greatest number on the taproot.

The gipsy moth quarantine (*Connecticut State Sta. Bul. Immed. Inform. 18 (1922), pp. 4*).—This is the text of State Quarantine Order No. 4, which became effective July 20, 1922.

Caterpillars à la Piute; an uncommon moth which defoliates the Jeffrey pine and in turn is eagerly devoured by the Indians, I. F. Eldredge (*Amer. Forestry, 29 (1923), No. 354, pp. 330–332, figs. 4*).—This paper relates to the Pandora moth (*Coloradia pandora*), the larvae of which serve as food for the Indians, as previously described by Aldrich (E. S. R., 27, p. 258).

Silver-striped webworm, Crambus praefectellus Zinck., G. G. Ainslie (*Jour. Agr. Research [U. S.], 24 (1923), No. 5, pp. 415–426, pl. 1, figs. 2*).—This is a report of studies of an American species of Crambus widely distributed

throughout the eastern half of the United States, which, while not often injurious, has shown itself capable of serious damage.

"It breeds continuously throughout the growing season. The generations are not distinct, but rearing records indicate that three generations per year is the usual number. The moths are not often abundant. They prefer waste or weedy land and are seldom found in clean grasslands. The larvae are readily reared on grasses. Winter is passed by the partly grown or mature larvae. The moths from the mature larvae emerge early in the spring and are the first Crambus moths to appear."

Striped sod webworm, Crambus mutabilis Clem., G. G. AINSLIE (*Jour. Agr. Research [U. S.], 24 (1923), No. 5, pp. 399–414, pls. 2, figs. 2*).—This is an account of a Crambus which is a common species throughout the eastern half of the United States and as far west as Iowa, Utah, and Texas, its food plants apparently being limited to the grass family. In the present paper the author presents a summary of previously published facts, together with the results of work extending over a period of several years, including technical descriptions of its several stages.

"It has been known to cause injury to young corn and to grasslands, but in such cases it is usually associated with some other species. There are three generations a year in Tennessee, the third being the smallest, and gradually diminishing northward until there are only two at the northern limits of the species. The moths are grass lovers and seek the lower and more luxuriant portions of pastures and meadows. They lay about 500 eggs, dropping them promiscuously as they fly. The larvae in the larger instars are distinctly striped and easily recognized. They construct tubular burrows in the earth opening at the surface and feed on near-by grasses, cutting off the leaves and dragging them into the burrows. In the fall they construct tubular nests among the grass stems, either above or partly in the ground, and pass the winter as partly grown larvae, completing their growth in the spring. *C. mutabilis* is more specialized than *C. hemiochrellus*, its nearest relative, and is evidently the terminus of one line of development in the genus. The larvae seem very susceptible to disease and are also frequently parasitized by both Hymenoptera and tachinids. Control measures consist of early fall plowing of sod lands intended for corn the following year and rotation of pastures and meadows where the insect is destructive. Ordinarily natural agencies prevent its injurious increase."

Amount of arsenic placed in calyx cups and lethal dosage for apple worm, L. HASEMAN (*Jour. Econ. Ent., 16 (1923), No. 3, pp. 270–275*).—The experiments reported show that "in thorough orchard spraying a killing dosage of arsenate of lead for young apple worms is placed in the calyx cup. A coarse spray under high pressure is not essential. The spray gun with high pressure is effective. The plats showing the greatest average calyx content had low though not the very lowest calyx infestation at picking time."

Codling worm life history, correlated spraying program, H. A. GOSSARD (*Ohio Sta. Mo. Bul., 8 (1923), No. 5–6, pp. 73–78, fig. 1*).—This practical account includes a life history chart which graphically represents the developmental conditions of the different stages of codling worm for the various periods of the year at Marietta, Wooster, and Gypsum and northern Ohio.

A new apple bud-moth in Pennsylvania, S. W. FROST (*Jour. Econ. Ent., 16 (1923), No. 3, pp. 304–307, pl. 1*).—*Sparganothis idacusalis* Wlk., which resembles the eye-spotted bud-moth in its habits and methods of feeding, has during the past five years been found feeding on apple, and in some years has been even more abundant than the latter.

Another step in the control of the Hessian fly, G. A. Dean (*Jour. Econ. Ent., 16 (1923), No. 3, pp. 288–291, fig. 1*).—The author finds that the Hessian fly can be controlled very well in Kansas by early, deep plowing of the stubble, destruction of volunteer wheat, delayed sowing, and cooperative work along these lines. Observations show that the fly lives over in relatively small, low, moist springy places, usually of less than 1 acre, though in some cases they may comprise from 40 to 80 acres. The destruction of the fly in all such areas by turning under the stubble, keeping them free from volunteer wheat, and restricting planting until after the fly-free date is recommended.

Five years of Hessian fly studies in Ohio, T. H. Parks (*Jour. Econ. Ent., 16 (1923), No. 3, pp. 299–304*).—A summary of investigations conducted by the author.

The resistance of wheat to the Hessian fly—a progress report, J. W. McColloch and S. C. Salmon (*Jour. Econ. Ent., 16 (1923), No. 3, pp. 293–298*).—A summary of the data here presented has been noted from another source (E. S. R., 49, p. 453).

Observations on the etiology of dengue fever, A. C. Chandler and L. Rice (*Amer. Jour. Trop. Med., 3 (1923), No. 3, pp. 233–262, figs. 6*).—The Texas epidemic of dengue fever here reported upon was accompanied by an unprecedented scourge of yellow fever mosquitoes (*Aedes aegypti*). Previous experimental work and the epidemiological evidence point very strongly to the agency of this mosquito in its transmission, and suggest that *Culex quinquefasciatus* played a very minor part, if involved at all. Studies of the relation of the mosquito to dengue fever in Louisiana, by Scott, have been noted (E. S. R., 48, p. 751).

Observations on Tabanidae (horseflies) in Louisiana, T. H. Jones and W. G. Bradley (*Jour. Econ. Ent., 16 (1923), No. 3, pp. 307–312*).—The larvae of 10 species of tabanids were collected in the field and reared to the adult stage, and 14 species additional to those recorded by Hine (E. S. R., 19, p. 161) were collected. In the vicinity of Baton Rouge in 1922 *Tabanus pumilus* was the worst of the tabanids attacking livestock. Two dipterous parasites were reared from tabanid larvae, namely, a dexiid (*Phasiops flava* Coq.) and a bombyliid (*Anthrax lateralis* Say).

The present status of knowledge of the control of ox warbles, Peter (*Berlin. Tierärztl. Wchnschr., 39 (1923), No. 19, pp. 207–210*).—This consists of a review of recent control work.

A Japanese tachinid parasite of the oriental moth, Cnidocampa flavescens Walk., J. N. Summers (*Jour. Econ. Ent., 16 (1923), No. 3, pp. 292, 293*).—The author records the parasitism of the oriental moth in Japan by the tachinid *Chaetexorista pavana* B. & B., where it is quite abundant in some portions of the infested area.

The blueberry maggot in Washington County, E. M. Patch and W. C. Woods (*Maine Sta. Bul. 308 (1922), pp. 77–92, pl. 1*).—This summary of information on *Rhagoletis pomonella* Walsh is a compilation in part from Bulletin 244 (E. S. R., 34, p. 851) and part from unpublished reports by the authors. It deals with the life history and habits of the pest, natural enemies, and control measures with reference to the canning industry.

A control for Japanese beetle larvae in golf greens, B. R. Leach and J. W. Thomson (*Jour. Econ. Ent., 16 (1923), No. 3, pp. 312–314*).—The authors find that emulsified carbon disulphid, when properly applied, will control the larvae of *Popillia japonica* Newm. with no injury to the turf. In fact, the material is a decided stimulant to the grass, its action being somewhat similar to that of sodium nitrate.

The Colorado beetle (*Jour. Min. Agr. [Gt. Brit.], 30 (1923), No. 1, pp. 59–62, figs. 2*).—A brief summary of information on the Colorado potato beetle, in which attention is called to the danger of its introduction into Great Britain from France, where in the neighborhood of Bordeaux about 100 square miles are infested (E. S. R., 48, p. 856).

Preliminary note on the two-colored coconut leaf beetle (Plesispa reichei Chap.), G. H. CORBETT (*Malayan Agr. Jour., 11 (1923), No. 3, pp. 64–69*).—This is an account of a chrysomelid beetle which is an important pest of the coconut palm in Malaya.

Control of the strawberry rootworm in commercial rose houses, C. A. WEIGEL and C. F. DOUCETTE (*Jour. Econ. Ent., 16 (1923), No. 3, pp. 283–288*).—"The results of three years' study of the seasonal and life histories of the strawberry rootworm (*Paria canella* Fab.) under greenhouse conditions are briefly reviewed as a basis in formulating an effective control program. Due to the long period of egg laying, the maximum numbers of beetles are present in June and July. The second brood emerges during September and October.

"The practice of replacing plants and soil at intervals of several years aids materially in ridding a house of these insects. Various control measures which have been tested in different localities on a commercial scale are discussed. A series of fumigations with hydrocyanic acid gas during the drying-off period, using 2 oz. of sodium cyanid per 1,000 cu. ft. of space with an exposure lasting 2 hours, killed 97 per cent of the beetles. (Muslin curtains proved effective in confining the gas in separate sections of open-range houses.) In one establishment as many as 60,000 beetles were collected in a week by persistent hand picking. Keeping the foliage dusted with a mixture of 10 or 15 lbs. of lead arsenate and 90 or 85 lbs. of superfine sulphur from February to November protected the plants and killed many beetles. Scraping a layer of soil 2 in. deep from the beds after the plants were cut back at the end of the drying-off period removed many beetles. The cut-back plants were then sprayed with arsenate of lead at the rate of 4 lbs. to 50 gal. of water to protect the breaking eyes. Filming the surface of the water which remains on the beds after syringing with kerosene nicotin oleate killed many beetles. A layer of wood ashes and tobacco dust on the beds operated to some extent against the larvae and pupae in the soil. Composting soil for several months or sterilizing before it is used in beds aids in keeping a greenhouse free from infestation."

The Plains false wireworm and its control, M. H. SWENK (*Nebraska Sta. Circ. 20 (1923), pp. 11, figs. 3*).—This is a report of studies of *Eleodes opaca* Say, which has seriously injured the last three crops of winter wheat, and especially the crop of 1922–23, in southwestern Nebraska, and particularly on the dry-land farms of Cheyenne, Kimball, Banner, Morrill, Garden, Deuel, Keith, Perkins, and Hitchcock Counties. The larvae destroy the planted seed in the fall and eat off the roots of the young plants both in the fall and in the spring, their attack in some cases resulting in the practical ruination of the crop.

There is but one generation each year, the adults being found common in the fields throughout the State from the middle of June to the middle of September. Eggs are deposited from early July to early October, mostly during August, the total number laid by each female varying from 25 to 400, with an average of about 100 eggs. Eggs laid in July and August will hatch in 6 to 10 days, while those laid in September or later may require up to 19 days. Eleven molts are passed during the larval period, which covers from 300 to 350 days. Pupation commences about the middle of May, the pupal period lasting from 8 to 20 days, with an average of 11 days.

Natural enemies mentioned include the braconid parasite *Perilitus eleodis*, the flesh-fly *Sarcophaga eleodis*, and two fungus diseases, *Sporotrichum globuliferum* and *Metarrhizium anisopliae*. Control measures considered include treating the seed, poisoning the adult beetles, and tillage and cropping methods.

Recent developments in plum curculio investigations in Georgia, O. I. SNAPP (*Jour. Econ. Ent., 16 (1923), No. 3, pp. 275–283*).—Extensive investigations started in 1921 have determined the occurrence in the latitude of central Georgia of two generations annually of the plum curculio, and that a large percentage of the larvae injuring the best late varieties of peaches are larvae of the second generation. A third generation was carried through in the insectary in 1922.

"Picking up and destroying the small peaches that fell several weeks after the pollination season assisted greatly in correcting Georgia's abnormal curculio conditions and is a wise supplementary control measure in latitudes where there are two generations of the insect. In one orchard a net saving of $5.25 per acre resulted from the operation. Disking to break up the pupal cells in the soil and burning over hibernating quarters during the winter months are other supplementary control measures that were successfully utilized. The investigations show that the ideal spraying or dusting schedule for the control of the plum curculio on peach in latitudes where there are two generations consists of four treatments of arsenate of lead as follows: (1) Immediately after the petals fall, (2) when the fruit is exposed from the calyx, (3) two weeks after the second, and (4) four weeks before each variety is due to ripen. Four applications of lead is too much as an annual treatment for peach trees in the South. The four application schedule should be used when the curculio infestation is heavy, otherwise the lead in the third application should be omitted."

The boll weevil problem, W. D. HUNTER and B. R. COAD (*U. S. Dept. Agr., Farmers' Bul. 1329 (1923), pp. 2+30, figs. 5*).—In this practical account information on the boll weevil and recommendations for its control are brought up to date.

Studies on the temperature of individual insects, with special reference to the honeybee, G. B. PIRSCH (*Jour. Agr. Research [U. S.], 24 (1923), No. 4, pp. 275–288, pl. 1, fig. 1*).—In this contribution from the Minnesota Experiment Station, the literature on the subject is first reviewed at some length in connection with a list of 17 references. The methods employed and the body temperatures of bees observed are reported, the details being given in part in tabular form. The studies have led to the following conclusions:

"The average body temperature of the bee is 4.7° C. above that of the surrounding air when the air temperature is 5.5° and coincides with the air temperature when that is betwen 35 and 44°. At 52° or above the temperature of the bee's body is lower than that of the air if not exposed to the high temperature for a long period of time. The maximum fatal temperature of bees is about 46 to 48°, and the freezing point is about −1°. There is no appreciable difference between the body temperature of the Carniolian and Italian bees. Bees are not wholly subject to the temperature of their environment, but are capable within certain limits of regulating their body temperature. The ability of a colony to regulate its temperature is undoubtedly due to the ability of the individual to regulate its body temperature plus the ability to regulate and conserve the heat produced."

A study of the factors affecting the outdoor wintering of honeybees, G. E. KING (*Jour. Econ. Ent., 16 (1923), No. 3, pp. 321–323*).—This is an account of an investigation carried on under regular apiary conditions of the variable factors entering into the outdoor wintering problem.

Beekeeping for all, T. EDWARDES (*London: Methuen & Co., Ltd., 1923, pp. VIII+136, pls. 4, figs. 36*).—This is a popular handbook.

The Egyptian honeybee (Apis fasciata Latr.) or "Balady bee," L. H. GOUGH (*Bee World, 4 (1923), No. 10, pp. 191–194, fig. 1*).—A report of observations at the author's apiary at Maadi, near Cairo, Egypt.

Control of ant invasions, W. E. BRITTON (*Connecticut State Sta. Bul. Immed. Inform. 17 (1922), pp. 6*).—This is a brief practical summary of information.

A note on the effect of sulphur on black currant mite, A. H. LEES (*Jour. Pomol. and Hort. Sci., 3 (1923), No. 2, pp. 103–105*).—Experiments here reported clearly demonstrate the great value of sulphur in controlling mites.

FOODS—HUMAN NUTRITION.

The Food Research Institute, Stanford University, 1922–23 (*Stanford University Calif., 1923, pp. 8*).—This is a brief outline of the foundation, organization, general policies, and scope of the research work of the Food Research Institute affiliated with Stanford University. A list of contributions on the researches of the institute, which have been published in various journals, is appended.

Lamb and mutton and their use in the diet (*U. S. Dept. Agr., Farmers' Bul. 1324 (1923), pp. II+14, fig. 1*).—This publication, which supersedes Farmers' Bulletin 526 (E. S. R., 29, p. 159), contains brief directions for the farm slaughter of lamb and mutton, methods for the temporary preservation of the meat and the utilization of the fat, suggestions as to the proper selection and use of the meat, and recipes selected to include all of the different cuts of the carcass and also left-over cooked meat. Recipes are also included for various sauces and relishes suitable for serving with roast and boiled lamb and mutton.

Flour and bread making, R. HARCOURT and M. A. PURDY (*Ontario Dept. Agr. Bul. 285 (1922), pp. 48, figs. 12*).—This is a revised edition of Bulletin 180, which has been noted previously (E. S. R., 23, p. 270).

Moldy bread outbreak due to infected flour (*Wisconsin Sta. Bul. 352 (1923), pp. 74, 75*).—An investigation by W. C. Frazier of an outbreak of mold in bread from a certain baking company resulted in the discovery that one of the two brands of flour used had a very high mold content, 11,000 spores per gram. On discontinuing the use of this infected flour there was no further trouble.

On examination of the moldy loaves it was found that the mold first began to develop in a crease in the loaf formed by the partitions between the series of pans. It is thought that the rapid drying out of the dough at this point enabled the mold spores to withstand the heat of baking. The subsequent development of the spores was furthered by the wrapping of the bread, thus preventing the moisture from escaping.

The digestibility of raw starches, S. WOODRUFF (*Jour. Home Econ., 15 (1923), No. 5, p. 276*).—An editorial summary reporting U. S. Department of Agriculture experiments on the digestibility of raw starches, previously noted (E. S. R., 43, p. 365; 47, p. 763).

Metabolism in China, B. E. READ and S. Y. WANG (*Philippine Jour. Sci., 22 (1923), No. 2, pp. 127–139*).—Data are reported on the chemical composition of the urines of Chinese residents of Peking, representing various classes and diets, including 10 convalescent hospital patients on low-protein diets; 4 normal subjects (laboratory helpers) on a vegetarian diet of wheat, rice, and beans; 6 students on a vegetarian diet; 18 students on the ordinary Chinese mixed

diet; and some of these students on diets containing an excessive amount of meat according to Chinese standards. These data are compared with similar data reported by Young for Europeans in Queensland (E. S. R., 33, p. 366), Campbell for Europeans and Asiatics in Singapore (E. S. R., 44, p. 763), and McCay for Bengali (E. S. R., 24, p. 568).

The values for total nitrogen were in all cases much lower than the normal European standards, averaging 0.176 gm. per kilogram of body weight for students on diets furnishing moderate amounts of meat and 0.259 gm. on diets furnishing excessive amounts of meat. The urea nitrogen was also low, particularly in the case of convalescent patients. The percentage of ammonia nitrogen was much above the European normal, but agreed closely with the figures reported by Campbell and McCay. The values for the students on the no meat, moderate meat, and excessive meat dietaries were 6.7, 7.4, and 6.9 per cent, respectively. "Disregarding climate, we believe high cereal diets to be the cause, or it may be a racial characteristic."

The values obtained for the creatinin coefficient (milligrams per kilogram of body weight) resembled the European standards, but varied with the diet. In general the physique of the different groups followed the absolute creatinin values, the students who had the best physique having the highest creatinin excretion. The uric acid output, both in absolute amounts and in percentage, was similar to the data reported by Campbell from Singapore. The values for neutral sulphur were very high, these being attributed to dietary causes.

The results in general confirm those of others on Asiatic subjects, but since the climate of Peking, with its severe winters, is so different from that of Singapore, it is concluded that heat and humidity are not the controlling factors in the metabolism of Asiatic subjects.

Synthesis of amino acids in the animal organisms.—II, The synthesis of ornithin in the body of the fowl, J. H. Crowdle and C. P. Sherwin (*Jour. Biol. Chem., 55 (1923), No. 3, pp. 365–371*).—Continuing the series of studies previously noted (E. S. R., 47, p. 563), the authors have attempted to determine whether ornithin can be synthesized in the body. For this purpose large cocks were used on account of the fact that when fowls are fed benzoic acid this is excreted in combination with ornithin as dibenzoyl ornithin, or ornithuric acid. The fowls were provided with an artificial anus so that the urine could be collected separately from the feces. As thus obtained, the urine was found to consist of two parts, a thin serous liquid and a pasty white precipitate. These were both analyzed for total nitrogen, uric acid, urea, ammonia, creatin-creatinin, and free and combined benzoic acid.

The data reported were obtained on a single cock during an experimental period of about 4 weeks. The diet during this time was practically nitrogen-free and consisted of unpolished rice, boiled potato, and water, with a small amount of yeast. To this was added 1 gm. of benzoic acid on the sixth, seventh, tenth to thirteenth, nineteenth to twenty-second, and twenty-fourth days. One gm. of histidin was administered on the sixteenth day, 2 gm. of histidin on the twentieth and twenty-first days, 1.25 gm. of prolin on the twenty-second day, and 1 gm. of arginin on the twenty-fourth day.

That the so-called combined benzoic acid was an ornithin derivative was proved by the separation from it of both benzoic acid and ornithin. Each period of benzoic acid feeding was followed by an increase in the total nitrogen excretion. This was accompanied by a slight absolute increase in the uric acid excretion, but relatively there was a decided decrease in uric acid. This is thought to indicate that the nitrogen for the amino groups in the ornithin synthesis is taken from the waste fraction of nitrogen which under ordinary conditions would appear as uric acid. Arginin increased the output of ornithuric

acid, but histidin and prolin had little effect upon it, which would appear to furnish evidence that histidin is not easily converted into arginin. The output of urea appeared to be increased by prolin and histidin and that of creatin-creatinin by arginin.

Studies in uric acid metabolism.—III, The influence of fats and carbohydrates on the endogenous uric acid elimination, H. B. LEWIS and R. C. CORLEY (*Jour. Biol. Chem., 55 (1923), No. 3, pp. 373–384*).—The series of studies previously noted (E. S. R., 40, p. 175) has been extended to a similar investigation of the influence of fats and carbohydrates on the hourly elimination of endogenous uric acid. Four men served as subjects, but with one exception the data reported were obtained on a single subject. The plan of the experiment and the methods employed for determining uric acid were the same as in the previous studies. The results obtained were as follows:

Fat in the form of cream in amounts up to 135 gm. had no effect upon the amount of uric acid eliminated by the fasting individual. Glycerol in 50-gm. amounts caused a marked increase in the uric acid output during the second and third hours after its ingestion, but amounts equivalent to the glycerol content of the fat had no effect. The previously noted stimulating action of amino acids (glycocoll) on uric acid excretion was not affected by the previous ingestion of fat.

Lactose, sucrose, and glucose in 100-gm. amounts did not influence uric acid elimination, but honey and commercial glucose sirup in amounts greater than 200 gm. increased somewhat its elimination. "It is believed that these results support the theory that the increases in the output of endogenous uric acid, following the ingestion of nonpurin foodstuffs are due, in part at least, to a general stimulation of cellular metabolism, occasioned by the presence of the foodstuffs or their products of catabolism in the cells."

The physical growth of children from birth to maturity, B. T. BALDWIN (*Iowa Univ. Studies Child Welfare, 1 (1921), No. 1, pp. 411, figs. 81*).—This "intensive analysis of the problem of physical growth" is presented in six main sections, as follows:

"Part I of this study states the problem under consideration, discusses anthropometric instruments and methods, and outlines the anthropometric service of the Child Welfare Research Station, with some results from 5,772 Iowa children. Part II gives as original data 5,000 weight measurements on 400 infants, the height and weight of 9,074 infants with comparative curves from other investigations, the height and weight of 27,912 preschool children, also 400 individual growth curves and 1,548 total or partial coefficients of correlation. Part III presents an analysis of original data in the anatomical and physiological ages from 6,500 boys and girls. Part IV includes an historical survey, in classified and chronological order, of 911 investigations in physical growth in this country and abroad. Part V summarizes in 643 comparative tables of measurements on infants, preschool children, school children, and adults under 30 years of age, data from all available authorities, comprising approximately 5,385,400 recorded cases in various countries. Part VI is an annotated bibliography in alphabetical order of the 911 titles on the problem of the growth of infants, children, and adults."

The effect of adding orange juice to the diets of underweight children, F. NEWELL and E. W. MILLER (*Jour. Home Econ., 15 (1923), No. 5, pp. 241–248, fig. 1*).—According to the authors' summary, the results obtained are suggestive rather than conclusive. "Experimental work where conditions of laboratory control prevail is essential to a definite knowledge of the effect of dietary additions on stimulation of growth in underweight children. This work has demon-

strated, however, an unmistakable rise in the weight curve of such children produced by the daily administration of 45 cc. of orange juice. This result may be the effect of added vitamin A, B, or C, or of inorganic constituents, which may either supplement a deficiency of these substances or produce some other change, such as a shift in the acid-base equilibrium."

Contribution to the vitamin question, L. SIEFFERT (*Schweiz. Apoth. Ztg., 60 (1922), Nos. 23, pp. 301–305; 24, pp. 313–319, figs. 7; 25, pp. 329–335, figs. 2*).—This paper includes a general discussion on the nature and function of the vitamins, together with the report, illustrated by growth curves and photographs, of an investigation of the value of malt extract and the commercial preparation Ovomaltine as sources of vitamins. The former is shown to contain vitamin B and the latter vitamins A and B. The experiments reported also show the effect of lack of vitamin A on reproduction as well as on growth of rats. Among the pathological changes resulting from the lack of vitamins A and B, particular emphasis is placed on the loss of water from the system. The author is of the opinion that the vitamins in some way control the metabolism of salts.

The vitaminic action of thermostable substances, P. DI MATTEI (*Arch. Farmacol. Sper. e Sci. Aff., 35 (1923), Nos. 1, pp. 5–16; 2, pp. 17–30*).—The author reports success in curing pigeons in the acute stages of polyneuritis by the administration of a 5 per cent infusion of roasted coffee. The initial dose employed was 8 or 10 cc., which was gradually increased to from 12 to 16, and finally to 20 cc. daily. It is noted that while the characteristic symptoms of polyneuritis were relieved and kept from returning by the administration of coffee the weight of the pigeons remained stationary.

In attempts to determine the constituents of the coffee responsible for the antineuritic action, tests were made of the antineuritic properties of green coffee, theobromin, caffein, and urea. The green coffee had no antineuritic effect, the theobromin and urea a very slight, and the caffein a moderate effect, but not so marked as the coffee infusion.

In discussing these differences the possibility is suggested of a change of some constituent of the coffee from an inactive to an active form on heating. The conclusion finally drawn is that the favorable action is not due to a single substance but must be attributed to the physiological properties of several of the constituents of the coffee, insufficient in themselves but serving together to maintain the functional equilibrium of the organism.

The effect of cooking on the vitamin content of cabbage, W. H. EDDY ET AL. (*Jour. Home Econ., 15 (1923), No. 1, pp. 15–30, figs. 4*).—Essentially noted from another source (E. S. R., 47, p. 466).

The nutritive properties of milk with special reference to reproduction in the albino rat, II, H. A. MATTILL and N. C. STONE (*Jour. Biol. Chem., 55 (1923), No. 3, pp. 443–455, figs. 2*).—In this continuation of the investigation previously noted (E. S. R., 44, p. 560), an attempt was made to determine whether the reproductive failure of rats on an exclusive milk diet might be due to the presence of an inhibitory factor in the milk, the effect of which would be lessened by dilution.

A number of young rats were placed on a series of rations containing 80, 70, 60, and 50 per cent of milk powder, 10 per cent of lard, and from 0.8 to 2 per cent of salt mixture, with starch to 100 per cent. A few animals were also placed on whole-milk powder with 0.2 per cent of iron citrate. The animals on reaching maturity were mated with animals from other litters. In all 54 animals, 32 males and 22 females, were followed through the usual reproduction period.

The animals all grew at above the normal rate up to about 75 days of age, after which a decline in growth rate took place in both sexes, but to a greater degree in the females. At 175 days the females were 14, and the males 5 per cent under weight. Of the various rations those furnishing from 80 to 100 per cent of milk were inferior to those furnishing from 50 to 70 per cent. Reproduction was not successful on any of the rations, nor did a change to rations containing protein-free milk, cod liver oil, traces of potassium iodid, or even stock rat food restore this function. Mating of both sexes with fertile stock animals showed that the females were always sterile and the males not invariably so.

When 5 per cent of yeast was added to the 60 per cent milk ration, 8 out of 9 females produced 14 litters sired by males on the same ration, but none of the young lived.

From an examination of the gonads the conclusion is drawn that the males suffer a gradual decline in reproductive function, becoming complete in about 200 days, when the testes have shrunk to about half their normal size and show degenerative changes. The ovaries, on the other hand, though smaller than normal, appeared normal and showed evidence of frequent ovulation.

"It may be assumed provisionally that a milk ration is inadequate for adult growth of the female rat, and especially for ovarian, uterine, and mammary functions. Ovarian functions are the least disturbed of the three factors in reproduction. The addition of yeast tends to improve the uterine disability, but without making lactation successful. What the nature of this improvement is and what the other shortcomings of milk may be remain to be determined."

Vitamin A in whole milk, skimmed milk, and filled milk (*Wisconsin Sta. Bul. 352 (1923), pp. 14, 15, fig. 1*).—As the result of a further investigation by Steenbock and Sell of the distribution of vitamin A between whole milk and skim milk (E. S. R., 47, p. 464), it is concluded that skim milk contains only about 20 or 25 per cent as much vitamin A as whole milk. Further evidence of the inferiority of skim milk in this respect is given in the results of feeding experiments with young chicks on rations of white corn and milk. The chicks receiving skim milk died in from 4 to 6 weeks, while those receiving whole milk grew well without exhibiting leg weakness.

Tests of the nutritive value of filled milk have shown that young rats of the same litter do not grow nearly so well on filled milk as on normal whole milk of the same content of solids.

Relation of vitamin A to rickets (*Wisconsin Sta. Bul. 352 (1923), pp. 16–18, fig. 1*).—In continuation of a previous investigation of the effect upon dogs of lack of vitamin A (E. S. R., 46, p. 469), experiments have been carried out by H. Steenbock and J. H. Jones to determine the conditions necessary for normal bone development in dogs.

It was found that as much as 60 gm. of fresh green alfalfa or 42 cc. of orange juice would not prevent rickets in rapidly growing dogs. That the antirachitic substance as found in cod liver oil resembles vitamin A in its resistance to destruction by saponification was shown by the prevention of rickets in two dogs by the addition of twice-saponified cod liver oil as a supplement to the basal rickets-producing diet.

The influence of light on the prevention of rickets was demonstrated by the earlier appearance of rickets in two dogs kept in the dark than in two other dogs of the same litter and having the same rickets-producing diet, but kept in the light.

A special study was made by J. Dow of the effects of light on rats. Rats sensitized to sunlight by being fed buckwheat showed marked excitement when

exposed to the light; the ears, nose, feet, and tail developed an abnormal redness; the eyes became swollen; salivation increased; and occasionally convulsions, terminating in collapse and death, followed. Sensitized controls kept in the dark remained perfectly normal.

Vitamin B, I, II (*Jour. Biol. Chem., 55 (1923), No. 3, pp. 399–419, figs. 9*).—Two papers are presented.

I. *A modified technique in the use of the rat for determinations of vitamin B*, H. Steenbock, M. T. Sell, and E. M. Nelson (pp. 399–410).—In this paper evidence is presented that rats which have access to their excreta obtain sufficient vitamin B from the excreta to render vitamin B studies under these conditions of little value. Growth curves are presented which show that on diets low in vitamin B growth is very much less in those animals which are kept in cages provided with false screened bottoms than in those kept on shavings. That the inferior growth is due to lack of vitamin B is shown by the fact that the additional salts did not improve the growth of the animals kept on the screens, but additional amounts of vitamin B in the form of wheat germ caused decided improvement in growth.

Data are also reported on the quantitative relations in the vitamin B requirement of rats kept on screens and on shavings, the vitamin B being furnished by yeast and by yellow corn, respectively. On the basal diet growth continued for about 2 weeks when the rats were kept on shavings and was maintained for 1 week or less when on screens, the largest gain in the two cases being 22 and 9 gm., respectively. When the diet was supplemented with yeast in amounts varying from 0.5 to 8 per cent, from two to three times as much yeast was required for normal growth for the rats on screens as for those on shavings. With yellow corn 10 per cent of corn when the rats were on shavings gave better results than 20 per cent but poorer than 30 per cent when the animals were kept on screens. The maximum growth was not secured in the animals on screens until between 60 and 80 per cent of corn was contained in the ration. With ground oats the growth on 40 per cent was comparable with that on 40 per cent of corn, but not normal.

These experiments are thought to indicate that when ordinary grains are to furnish sufficient vitamin B they must constitute about 60 per cent of the diet.

II. *Storage of vitamin B by the rat*—Steenbock, Sell, and J. H. Jones (pp. 411–419).—In this investigation of the ability of rats to store vitamin B, two series of experiments were conducted. In the first 4 litters of rats which had been reared on a ration of yellow corn 76, linseed oil meal 16, crude casein 5, ground alfalfa 2, sodium chlorid 0.5, and calcium carbonate 0.5 parts, with milk ad libitum, were placed on the vitamin-free ration at the age of 3, 4, 5, and 6 weeks, respectively, 1 animal from each litter being used for each lot.

All of the animals lived for about 50 days after being put on the deficient diet, but the older the animal at the beginning of the experiment the greater its loss in weight before death. The time at which the animals began to lose weight varied with the age at which they were put on the diet, beginning in about 2 weeks in rats 3 and 6 weeks old, and after 1 week in rats 4 and 5 weeks old at the beginning of the experiment.

In the second series 8 pregnant females were segregated, their young reduced to 6 in number, and the animals fed in three lots on rations differing only in their content of vitamin B. This was varied by the substitution of from 10 to 20 parts of yellow corn by brewers' yeast. The three diets furnished no, 10, and 20 per cent of yeast, respectively. When the young were from 23 to 25 days old and weighed from 45 to 67 gm. each, 9 lots of 4 each were put on the vitamin B-deficient diet, and 1 week later 2 lots of 4 each, which had been kept since weaning on the rations containing 10 and 20 per cent of

yeast, were also started on the deficient ration. Again there was no significant difference in the survival periods of the animals which had been kept on the different diets, but in the cases in which there had been a larger amount of vitamin B in the diet or the vitamin B-containing diet had been kept up for a longer time, there was a greater gain in weight before failure ensued. "All the evidence points to little ability on the part of the rat to store vitamin B."

Does diet influence concentration of vitamin B in milk? (*Wisconsin Sta. Bul. 352 (1923), p. 18*).—Evidence that the amount of vitamin B in milk does not depend upon the amount of this vitamin in the ration from which this milk was produced was obtained by feeding cows a ration containing large amounts of wheat germ as a source of vitamin B and feeding the milk produced to rats. No evidence was obtained of an increased content of vitamin B in the milk.

Action on growth of vitamin B administered parenterally, E. Wollman and M. Vagliano (*Compt. Rend. Soc. Biol. [Paris], 88 (1923), No. 3, pp. 163, 164, fig. 1*).—It is reported briefly that if young rats which have been kept until stationary in weights on diets lacking both vitamins A and B are given cod liver oil by mouth and an extract of yeast by subcutaneous or intraperitoneal injection, the subsequent growth of the animals is not nearly so rapid as when the same amount of the yeast extract is given by mouth. This is thought to suggest the possibility that vitamin B exerts its action on growth only after absorption in the intestines and elaboration in a definite organ, probably the liver.

The action of vitamin A when administered parenterally, E. Wollman and M. Vagliano (*Compt. Rend. Soc. Biol. [Paris], 88 (1923), No. 5, pp. 336–338, figs. 2*).—Continuing the above study, attempts were made to determine the effect on the growth of young rats of the addition of vitamin B to the vitamin-deficient diet and the administration of vitamin A in the form of cod-liver oil and butter by subcutaneous and intraperitoneal injection.

It was found that the young animals in most cases could not stand repeated daily injections of these materials, one animal only surviving a daily injection of 0.3 cc. of cod-liver oil for about 16 days. During this period and for about 4 days later there was but little growth, after which the animal began to grow and continued growing for about 50 days.

In other experiments a single injection was given and not repeated until the animal had again ceased to grow, which was generally in about 20 days. On repeating the injection growth was resumed for about the same length of time. Similar injections of an inactive oil, vaseline, were without effect.

It is concluded that vitamin A can be utilized eventually whether given by the digestive tract or parenterally, but that in the latter case the action on growth is retarded to a greater or less extent by irregularities of absorption.

The utilization by the organism of vitamin C introduced parenterally, E. Lesné and M. Vagliano (*Compt. Rend. Acad. Sci. [Paris], 176 (1923), No. 9, pp. 614, 615*).—The authors report that they have succeeded in preventing the onset of scurvy in pregnant guinea pigs on a scorbutic diet by the subcutaneous injection of 3 cc. of freshly neutralized orange juice daily. After the animals had given birth to young (which in all cases were normal), the orange juice was administered intraperitoneally with equally good results.

Passage into the milk of vitamin C introduced parenterally, E. Lesné, Christov, and Vagliano (*Compt. Rend. Acad. Sci. [Paris], 176 (1923), No. 15, pp. 1006–1008, fig. 1*).—Evidence that vitamin C introduced parenterally is capable of passing into the milk of a lactating animal is shown by a continuation of the experiment noted above. It is stated that if the young of guinea

pigs on a scorbutic ration but receiving subcutaneous injections of orange juice as a source of vitamin C are kept with the mother, death from scurvy results in about 25 days, or about 7 days after lactation has ceased, but that if at the first appearance of symptoms of scurvy the young are transferred to another animal at the beginning of the lactation period, death from scurvy does not follow until about the forty-fourth day. The necessity is emphasized of furnishing nursing mothers with an abundance of foods rich in vitamin C.

The influence of calcium chlorid upon experimental botulism, I. C. Hall and N. C. Davis (*Jour. Expt. Med., 37 (1923), No. 4, pp. 585–599*).—Contrary to the results obtained by Edmondson, Giltner, and Thom (E. S. R., 45, p. 467), calcium chlorid given subcutaneously, intraperitoneally, or intravenously was found to have no effect upon the production of botulism following the injection of *Bacillus botulinus* into the peritoneal cavity of guinea pigs. It is thought improbable that the difference in results was due to the method of injection of the organisms and of the calcium chlorid, but possible that the difference can be explained on the basis of strain variability.

The conclusions of the above authors and of Orr (E. S. R., 47, p. 271) that toxin-free spores of *B. botulinus* are capable of producing botulism on injection are confirmed, but it was found impossible to produce botulism by feeding the spores. "It seems, therefore, that the possibility of human disease contracted from eating freshly cooked food contaminated with *B. botulinus* would be slight, as suggested by Burke, Elder, and Pischel [E. S. R., 45, p. 667]."

A confirmation is also given of the conclusion of Bronfenbrenner and Schlesinger (E. S. R., 46, p. 361) that the treatment of botulinus toxin with alcohol decreases its toxicity for guinea pigs.

ANIMAL PRODUCTION.

Experimental studies on the duration of life.—VII, The Mendelian inheritance of duration of life in crosses of wild type and Quintuple stocks of Drosophila melanogaster, R. Pearl, S. L. Parker, and B. M. Gonzalez (*Amer. Nat., 57 (1923), No. 649, pp. 153–192, figs. 17*).—In continuing the series of papers on duration of life in Drosophila (E. S. R., 49, p. 568), the results of a study are reported in crossing a wild type strain (Old Falmouth) having an average length of life of 44.26±0.44 days, with a vestigial wing type (Quintuple) having an average length of life of 14.08±0.23 days. The F_1s produced by reciprocal crosses had an average length of life of 51.55±0.47 days, which was greater than the average of either parent, due probably to heterosis. The F_1s were all normal winged. The average length of life of the 639 normal winged F_2s was 43.33±0.42 days, and of the 148 vestigial winged F_2s 14.6±0.57 days. Numerous back crosses and some F_3s were produced, but unlike the F_2s, the difference in length of life between the normal and vestigial winged flies and their parents was greater. There seemed to be a reduction in the length of life of both types. These differences may have been due to the small size of the population, or to segregation with other body characters which were not studied.

To show that the difference in length of life of the two original parent strains was genetic and not due to physiological differences arising from a lack of the ability to fly, the wings of 519 normal flies were clipped, and the length of life compared with 514 normal winged flies in which the wings were not clipped. The average length of life of the two groups were, respectively, 34.56±0.5 and 43.26±0.47 days. This shows a significant difference in duration of life of the two groups, but it is concluded that this was more probably the result of injury

to the clipped wing flies, since three times as many of the flies with clipped wings died during the first 10 days. The data for all matings are reported in detail.

Inheritance in the Y- (W) chromosome, R. GOLDSCHMIDT (*Biol. Zentbl., 42 (1922), No. 12, pp. 481–487*).—Evidence is presented to show that the F factor for femaleness in Lymantria is linked with the Y- (W) chromosome. In a cross Tokyo ♀ × Hokkaido ♂ a female was produced which when backcrossed with a pure Hokaido ♂ produced nothing but females one-half of which were normal and the other half were modified. These modified females possessed male genetic characters and had two X- (Z) chromosomes and no Y- (W) chromosomes. Their eggs were also formed without Y- (W) chromosomes.

Since the factor for femaleness F was shown to be carried normally in the Y- (W) chromosome, it is assumed that crossing over has occurred between the X- (Z) and Y- (W) chromosomes so that the F factor is in the X- (Z) chromosome in this case. Similar results have occurred in crossing a female carrying a dark color factor C located in the X- (Z) chromosome with a light male. Resulting offspring consisted of dark sons and light daughters, as would be expected in sex-linked inheritance, but one light son and one dark daughter were also produced, which the author concludes must have been due to crossing over in the X- (Z) and Y- (W) chromosomes. Reference is made to the work of T. Aida, in which crossing over in the X- and Y-chromosomes in *Lebistes* was previously noted (E. S. R., 48, p. 566).

Inactive ovaries cause of male plumage in hens (*Wisconsin Sta. Bul. 352 (1923), pp. 25–27, fig. 1*).—An account is given of a hen having male plumage which laid eggs. The explanation is that the ovaries were inactive at the time of molting. When this hen again molted with active ovaries she produced hen feathers.

New index shows quality of animal body (*Wisconsin Sta. Bul. 352 (1923), p. 25*).—A formula devised by C. R. Yapp to help differentiate between different types of animals is suggested.

$$I=\frac{H^2\times L}{W\times 475.8}$$

H equals height at withers, L equals length between pin bone and point of shoulder, W equals weight of the animal in pounds, 475.8 is a constant for the volume per pound of the animal, and I is the index to be determined. The principle of the formula is based on the proportionate amount of an imaginary rectangle that the animal will fill. The index gets gradually less as the animal gets older, which means that there is a gradual increased amount of the rectangle filled.

Nutritive value of the Georgia velvet bean (Stizilobium deeringianum), J. W. READ and B. SURE (*Jour. Agr. Research [U. S.], 24 (1923), No. 5, pp. 433–440, figs. 11*).—In continuing the study of the nutritive value of the Georgia velvet bean at the Arkansas Experiment Station (E. S. R., 46, p. 108; 47, p. 365), the results of 11 feeding experiments with rats are reported, consisting largely of graphs showing the growth curve of each animal. Weight was practically maintained by 4 rats for 6 weeks on a ration of 60 per cent cooked velvet-bean seed (hulled) and 40 per cent dextrin, but there was evidence of malnutrition after this period. The addition of a liberal supply of whole milk to the ration resulted in better than normal growth, and young were produced which grew normally, one of which produced young which made normal growth on the same ration.

The young of one rat were successfully reared, as well as the second and third generations, on a ration consisting of 60 per cent starch and 40 per

cent of the whole bean plant ground with a liberal supply of skim milk. In rations consisting of 53 per cent hulled velvet beans and 7 per cent hulls, it was determined that hulls offer no supplementing value to the deficiency of the seeds in protein, vitamin B, or salts, whereas the leaves furnish sufficient vitamin B and salts for normal growth. The velvet beans were shown to contain sufficient vitamin A for growth in a ration consisting of 60 per cent of the seeds (hulled). The replacement of 7 per cent of the seeds with hulls, either after autoclaving at 15 lbs. pressure for 2 hours or without autoclaving, reduced growth materially.

The feeding value of potato tops, F. Honcamp (*Landw. Vers. Sta., 100 (1922), No. 1–2, pp. 89–102*).—Experiments dealing with the composition and feeding value of potato tops are reviewed, and the results of digestion trials in which potato tops were fed to wethers are reported.

In two trials where clover hay and potato tops were fed it was determined that 100 kg. of potato tops contained 3.9 and 2.8 kg. of digestible pure protein and 30.7 and 27.6 kg., respectively, of starch value. The content of digestible nutrients in the samples used in the two tests was determined, respectively, as follows: Crude protein, 6.89 and 4.16 per cent; nitrogen-free extract, 30.44 and 22.75 per cent; crude fat, 1.26 and 1.56 per cent; and crude fiber, 12.93 and 17.29 per cent. The lower feeding value as observed in the second test was caused by the high sand content of the tops used. It is concluded that potato tops are similar to meadow hay in feeding value.

The loss of crude and digestible nutrients in the preparation of brown hay, F. Honcamp (*Landw. Vers. Sta., 100 (1922), No. 1–2, pp. 79–88*).—A review of the work of H. Weiske is given in which he found that there was a greater loss of digestible nutrients, except nitrogen-free extract, in alfalfa hay than when alfalfa was prepared as brown hay.

A similar study by the author is reported with serradella, in which the nutrients in the green plant, dry hay, and brown hay, and the digestibility of each were determined with 2 wethers. Analyses indicated that the losses by drying and by making into brown hay were, respectively, 53.6 and 43.7 per cent in dry matter, 52.4 and 42.9 per cent in organic matter, 60.3 and 52.3 per cent in crude protein, 53.7 and 42.4 per cent in nitrogen-free extract, 76.1 and 67.9 per cent in crude fat, 39.6 and 31.7 per cent in crude fiber, and 64.5 and 51.2 per cent in ash. The average coefficients of digestibility for the nutrients of the dry hay and the brown hay were, respectively, organic matter, 56 and 55.5 per cent; crude protein, 70.8 and 58.8 per cent; nitrogen-free extract, 61.7 and 61.1 per cent; crude fat, 63.3 and 76 per cent; and crude fiber, 41.9 and 44.7 per cent. From these data it is calculated that from 1,000 kg. of the green plant there were 9.7 kg. of digestible protein and 31.9 kg. of starch value in the dry hay and 10.5 kg. digestible protein and 38.3 kg. of starch value in the brown hay.

Experiments with silage [at the Wisconsin Station] (*Wisconsin Sta. Bul. 352 (1923), p. 77*).—In studying the losses of silage from decomposition, tests have been made of the Fink silo seal by E. B. Fred and W. H. Peterson, and it has been found that losses occur even when the silos are sealed by this means. Losses in dry matter of from 4 to 8 per cent have also been found to occur in making corn silage.

Feeding trials with beef cattle [at the Wisconsin Station] (*Wisconsin Sta. Bul. 352 (1923), pp. 23, 24, fig. 1*).—Two trials in fattening beef animals were conducted by J. G. Fuller.

Baby beef production.—Two lots of well-bred beef calves from 9 to 12 months of age and weighing from 600 to 650 lbs. were fed for 140 days. One lot consisting of 6 heifers received a ration of 1.8 lbs of cracked corn, 2.6 lbs. of crushed oats, 1.9 lbs. of bran, 0.68 lb. of oil meal, 14.1 lbs. of corn silage, and 3

lbs. of mixed hay daily, and made an average daily gain of 1.6 lbs. The other lot, composed of 7 steers, received a ration of 7.1 lbs. of cracked corn, 1.3 lbs. of oil meal, 14.7 lbs. of corn silage, and 3 lbs. of mixed hay, making an average daily gain of 1.8 lbs. The profits over feed cost in the two lots were, respectively, $27.87 and $62.85

Sunflowers v. corn silage for fattening steers.—To compare sunflower and corn silage for fattening 2-year-old steers, two lots of 10 steers each were selected for a 154-day feeding period. The rations consisted of 8.6 lbs. of broken ear corn, 1.5 lbs. of cottonseed meal, and 3.1 lbs. of mixed hay in both cases, with the addition of 24 lbs. of corn silage for lot 1 and an equal amount of sunflower silage for the other lot. The average weights of the animals were 677 lbs. in both lots at the start of the test and 1,001 lbs. in the corn silage and 1,004 lbs in the sunflower lot at the close of the test. The profit over feed cost produced per steer in the corn silage lot was $11.32, and in the sunflower silage lot $9.22, the difference being largely due to a difference in the amount of pork produced.

Sheep farming in New Zealand, W. Perry et al. (*Auckland, N. Z., Melbourne, and London: Whitcombe & Tombs, Ltd. [1923], pp. 11+161, pls. 20, figs. 4*).—This is a text on sheep farming, taking up such subjects as choosing and equipping a sheep farm, breeds of sheep in New Zealand, feeding, management, breeding, and diseases of sheep, and the growth and structure of wool and its preparation for sale.

Roughage for wintering pregnant ewes, A. A. Dowell and J. E. Bowstead (*Alberta Univ., Col. Agr. Bul. 1 (1923), pp. 50*).—The complete results of 3 years' experiments in wintering pregnant ewes are given in detail. The first year's results were previously noted (E. S. R., 43, p. 870). The following table gives the types of roughages fed and the composite results of all the experiments:

Summary of experiments in wintering pregnant ewes on roughages.

Kind of feed.	Number of years.	Number of ewes.	Loss in eight during pregnancy.	Average number of lambs per ewe.	Strong lambs.	Average weight of lambs.	Gain in weight of fleece.	Average daily feed per ewe.		Cost of feed per ewe.
								Hay.	Other feed.	
			Lbs.		*Per ct.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	
Alfalfa hay	3	20	8.4	1.40	92.9	9.47	1.328	3.90	.....	$5.00
Prairie hay	3	21	20.9	1.33	100.0	8.71	.369	3.31	.....	3.08
Timothy hay	3	21	21.2	1.24	88.5	8.50	.035	3.23	.....	3.93
Oat hay	3	20	12.9	1.30	53.8	7.95	.780	3.59	.....	2.82
Oat hay and prairie hay (equal parts)	3	19	14.1	1.58	100.0	8.56	.746	3.63	.....	3.06
Prairie hay, grain, and water	2	9	1.7	1.33	100.0	10.14	1.440	3.12	[1] 0.65	4.20
Prairie hay, grain, and snow	2	10	1.5	1.30	100.0	9.54	1.550	3.11	[1] .625	4.20
Oat straw and turnips	2	8	22.8	1.75	100.0	7.99	−.185	[2] 3.32	[3] 4.28	2.33
Alfalfa hay and oat straw (equal parts)	2	10	12.8	1.50	86.7	8.63	1.090	2.06	[2] 2.02	3.38

[1] Whole oats. [2] Oat straw. [3] Turnips.

Lamb feeding experiments in western Nebraska, J. A. Holden (*Nebraska Sta. Bul. 194 (1923), pp. 35, fig. 1*).—This is a complete report of two lamb-feeding experiments carried on at the Scottsbluff Substation from 1916 to 1922 (E. S. R., 47, p. 775). Each experiment consists of 3 years' results. In the first experiment 10 lots of 30 lambs each were fed each year for 76 days in the winter of 1916–17, and for 100 days in the winters of 1917 to 1919. During the second experiment 12 lots of lambs were fed for 100 days in the winter

of 1919–20, 120 days in 1920–21, and 80 days in 1921–22. There were 31 lambs per lot the first year and 25 in each of the other years.

All lots of lambs received alfalfa hay ad libitum, and in the first experiment the additional feeds which were compared, as follows: Lot 1 shelled corn, lot 2 shelled corn and dried beet pulp in equal parts, lot 3 dried beet pulp, lot 4 corn and beet tops, lot 5 corn and wet beet pulp, lot 6 wet beet pulp and molasses, lot 7 no additional feed, lot 8 sugar beets, lot 9 beet tops, and lot 10 a heavy feed of corn (1½ lbs. per lamb per day). The following feeds were compared in the second experiment: Lot 1 shelled corn; lot 2 shelled corn and cottonseed cake; lot 3 shelled corn for the first 40 days and dried beet pulp for 60 days; lot 4 shelled corn for 40 days, dried beet pulp for 60 days, and cottonseed cake; lot 5 dried beet pulp; lot 6 dried beet pulp and cottonseed cake; lot 7 dried beet pulp and ½ lb. cottonseed cake per day; lot 8 dried beet pulp, cottonseed cake, and corn silage; lot 9 cottonseed cake and corn silage; lot 10 shelled corn and beet tops; lot 11 dried beet pulp, cottonseed cake, and beet tops; and lot 12 cottonseed cake and beet tops. After getting the lambs on feed (about 25 days) they received 1 lb. per day of the corn, dried beet pulp, or corn and dried beet pulp. Cottonseed cake was fed at the rate of ⅓ lb. per day except for lot 7 in the second experiment. Wet beet pulp, sugar beets, sugar-beet tops, and alfalfa hay were fed according to the appetite.

The lambs used in the tests varied somewhat in initial weight each year as follows: 55 lbs., 60, and 54 lbs. for the first experiment, and 42, 43, and 63 lbs. during the different years of the second experiment. The following table gives a summary of the combined 3-year averages for each lot in each experiment:

Summary of six years' comparative feeding tests in fattening lambs in western Nebraska.

Experiment.	Lot.	Number of lambs.	Average gain per lamb.	Feed consumed per 100 lbs. gain.								Selling price per 100 lbs.
				Corn.	Cottonseed cake.	Dry pulp.	Beet tops.[1]	Wet pulp.	Molasses.	Corn silage.	Alfalfa hay.	
			Lbs.	*Lbs.*	*Lbs.*	*Lbs.*	*Tons.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	
1	1	90	27.5	313	.....	.....	.....	.....	.....	.....	720	$9.75
1	2	90	27.7	161	.....	161	.....	.....	.....	.....	655	9.60
1	3	90	25.6	.....	.....	338	.....	.....	.....	.....	837	9.75
1	4	90	32.6	261	.....	.....	1.38	.....	.....	.....	518	9.85
1	5	90	30.0	255	.....	.....	.....	1,462	.....	.....	627	10.00
1	6	90	19.6	.....	.....	.....	.....	3,005	188	.....	910	9.75
1	7	90	8.9	.....	.....	.....	.....	.....	.....	.....	4,190	8.70
1	8	90	19.2	.....	.....	.....	.....	[2] 1,890	.....	.....	1,020	9.25
1	9	90	19.0	.....	.....	.....	4.6	.....	.....	.....	1,000	9.25
1	10	90	27.5	374	.....	.....	.....	.....	.....	.....	678	9.50
2	1	81	30.2	302	.....	.....	.....	.....	.....	.....	583	9.75
2	2	81	37.3	242	81	.....	.....	.....	.....	.....	457	9.95
2	3	81	28.6	129	.....	204	.....	.....	.....	.....	631	9.70
2	4	81	35.3	105	87	166	.....	.....	.....	.....	486	9.85
2	5	81	27.1	.....	.....	357	.....	.....	.....	.....	652	9.65
2	6	81	34.9	.....	87	267	.....	.....	.....	.....	478	9.85
2	7	81	37.9	.....	118	245	.....	.....	.....	.....	453	9.90
2	8	81	38.5	.....	79	242	.....	.....	.....	499	285	10.00
2	9	81	22.1	.....	137	.....	.....	.....	.....	972	561	9.20
2	10	81	34.8	260	.....	.....	1.68	.....	.....	.....	391	9.80
2	11	81	39.1	.....	77	238	1.49	.....	.....	.....	355	9.85
2	12	81	25.8	.....	117	.....	2.47	.....	.....	.....	597	9.40

[1] Tops from tons of beets. [2] Whole sugar beets.

Corn proved to be the most efficient feed used with alfalfa hay, but dried beet pulp proved a good substitute for corn, especially when fed with cottonseed cake. The addition of such succulent feeds as beet tops, wet beet pulp, or corn silage to the ration usually tended to increase the gains made. Molasses

with alfalfa hay or alfalfa hay alone were unsatisfactory rations. The feeding of cottonseed cake in amounts of ⅓ lb. per day and corn in amounts of 1 lb. per day were more profitable than feeding ½ and 1½ lbs. daily of the respective feeds.

Records of the shrinkage of the lambs indicated that lambs receiving beet tops or corn silage seemed to shrink most, but there appeared to be no difference in the shrinkage, dressing percentage, or quality of the meat between corn fed lambs and lambs receiving dried beet pulp when the finish in both cases was the same, but ordinarily corn fed lambs carry a higher percentage of fat.

[Experiments in hog feeding at the Wisconsin Station] (*Wisconsin Sta. Bul. 352 (1923), pp. 18–21, figs. 2*).—The hog feeding experiments have dealt largely with the vitamin deficiency of certain rations.

Yellow v. white corn for swine feeding.—As in earlier trials (E. S. R., 47, p. 467), F. B. Morrison and J. M. Fargo found a white corn and skim milk ration deficient in vitamins. At the end of a trial in feeding white corn and skim milk all but 4 of 10 pigs employed in the test had died or showed the effects of a lack of vitamins, whereas other pigs on yellow corn and skim milk made average daily gains of 1.02 lbs. per head daily. Pigs weighing 142 lbs. at the start of the test, however, were able to make nearly as good gains on white corn and skim milk as other lots did on yellow corn and skim milk. This was possible because of the store of the fat-soluble vitamin in the liver and other organs previous to the test.

How can we feed white corn to young pigs in winter?—By feeding 5 per cent of chopped alfalfa, young pigs were able to make excellent gains on a white corn and skim milk ration. It is suggested that probably chopped clover or soy bean hay would also supply the vitamins and thus make possible the successful feeding of white corn to pigs in the winter.

Efficient rations for fall pigs.—It has been determined in experiments by Morrison and Fargo that pigs fed corn and tankage in dry lot will become unthrifty, but the deficiency is overcome by adding a little alfalfa hay to the ration, with better results when a little linseed meal is also added. In three trials pigs receiving corn and tankage made average daily gains of 0.95 lb., but where linseed meal and alfalfa hay were included the gains were 1.21 lbs. These feeds may be self-fed or balanced in the mixture.

Scientific pig keeping, with its relation to vitamins, M. J. Rowlands (*Jour. Farmers' Club [London], 1921, pt. 7, pp. 133–151*).—This is mainly a discussion of the importance of each of the vitamins in pig feeding.

Feeding trials with draft foals [at the Wisconsin Station] (*Wisconsin Sta. Bul. 352 (1923), p. 24*).—In an experiment conducted by J. G. Fuller one lot of seven purebred draft foals receiving a daily ration of 11.4 lbs. of grain (crushed oats and wheat bran 9:1) and 6.4 lbs. of alfalfa hay made average daily gains of 1.9 lbs. during a 182-day test. The average weight of these animals at 377 days of age was 1,141.4 lbs.

[Feeding experiments with poultry at the Wisconsin Station] (*Wisconsin Sta. Bul. 352 (1923), pp. 7–10, figs. 3*).—The following experiments in poultry feeding are briefly reported.

Feeding eggs to baby chicks gets results.—J. G. Halpin and E. B. Hart have found that the addition of small amounts of egg to the ration of chicks would produce good results and be of assistance in raising early spring chicks. It is suggested that the eggs be beat up with skim milk, which is mixed with the mash. When eggs are fed, greed feeds may be eliminated.

Quality of hatching eggs depends upon the ration.—In experiments by Halpin and H. W. Steenbock lots of hens were fed different rations, and the percentage

of hatchability of the fertile eggs determined as follows: White corn and casein, 15.3 per cent; yellow corn and casein, 23.6; white corn, casein, and pork liver, 53.2; and yellow corn, casein, and pork liver, 62 per cent. By using skim milk powder or dried pig heart in place of the pork liver the hatching percentages were markedly reduced, especially on the white corn ration. This emphasizes the necessity of supplying breeding hens with adequate amounts of vitamin B.

Experimental results in fattening chickens, M. A. JULL and W. A. MAW (*Poultry Sci., 2 (1923), No. 4, pp. 101–111*).—The results of 7 years' experiments carried on in fattening large-sized and medium-sized chickens with different rations at Macdonald College, Quebec, are reported. A portion of these results has been previously noted by the junior author (E. S. R., 47, p. 872).

The general conclusions were that the large-sized chickens (average over 4 lbs.) required a fattening period of about 10 days, while medium-sized chickens averaging under 3 lbs. required a fattening period of about 2 weeks. The ration for fattening chickens, consisting of two or more staple grains, should either be moistened with sour milk or should contain 10 per cent of beef scrap for the production of the most economical gains.

Feeding and marketing the broilers, D. C. KENNARD (*Ohio Sta. Mo. Bul., 8 (1923), No. 5–6, pp. 79–83*).—Practical instructions for crate fattening and pen fattening broilers are given, with the results of experiments in crate fattening White Leghorn cockerels at the station in 1922. The initial weights varied from 1.15 to 1.34 lbs., and the birds made average gains during a 2 weeks' period of from 0.4 to 0.58 lbs. each. The ration feed consisted of ground corn 3 parts, standard wheat middlings 1 part, and skim milk 6 parts. Directions for marketing and shipping broilers are also given.

The vitamin requirements of growing chickens, H. H. MITCHELL, F. E. KENDALL, and L. E. CARD (*Poultry Sci., 2 (1923), No. 4, pp. 117–124*).—After reviewing several experiments dealing with the vitamin requirements of growing chicks, the authors report tests carried on at the Illinois Experiment Station to determine the requirements of growing chicks for vitamins A and C.

Two lots of 25 Rhode Island Red chicks were started immediately after hatching on a ration of coarsely ground corn and a mash containing 1 part tankage, 2 corn bran, and the mealy portion of 3 parts of ground corn. All the corn products making up the ration of one lot were from white corn, whereas the corn used in the ration for the other lot was yellow. A small portion of dried yeast was added to both rations to insure a sufficiency of vitamin B.

During the first 7 weeks both lots received approximately the same amount of feed according to live weight, but all the chicks receiving the white corn ration developed leg weakness in 3 or 4 weeks and 18 were dead at the end of 7 weeks, the other 7 chicks being saved by the administration of cod liver oil at the end of 5 weeks. Eight chicks had been lost at the end of 7 weeks from the lot receiving yellow corn.

The living chicks receiving the white corn ration averaged 39 gm. at the start and 147 gm. at the end of 5 weeks. The corresponding weights of the chicks on the yellow corn ration were, respectively, 41 and 151 gm.

At the end of 6 weeks the chicks receiving the yellow corn ration began to die, showing symptoms of leg weakness, and 8 of them were given cod liver oil. The chicks from both lots receiving cod liver oil that survived the first 48 hours after starting it grew to weights of from 600 to 905 gm. at the end of 12 weeks of cod liver oil feeding, whereas all the other chicks died or became so emaciated that it was necessary to kill them.

To determine the requirements for vitamin C the surviving chicks at 13 weeks of age were put on a ration of yellow corn, tankage, yeast, and cod liver oil, and in addition tomato juice in one-half of which the vitamin C had been destroyed by heat and sodium hydroxid. The individual gains in weight to 21 weeks of age showed much variation, the averages being 968±62 gm. for those not receiving vitamin C and 730±69 gm. for those receiving vitamin C.

The authors conclude that chicks may thrive on rations lacking vitamin C, but that they require more vitamin A for normal growth than rats.

Buttermilk as a supplement to corn meal when fed to chickens, D. C. KENNARD, R. C. HOLDER, and P. S. WHITE (*Poultry Sci., 2 (1923). No. 4, pp. 125–128*).—The value of buttermilk as a source of minerals for poultry is emphasized by reporting an experiment from the Bureau of Chemistry, U. S. D. A., in which rations of 40 parts corn meal and 60 parts liquid buttermilk were fed to cockerels and hens in comparison with similar rations in which 1.2 parts of a salt mixture (20 per cent $CaCO_3$, 20 NaCl, and 60 per cent bone ash) replaced an equal amount of corn meal. The gains made showed no particular advantage for the lot receiving the mineral mixture, indicating that sufficient minerals were present in the buttermilk. The analyses of samples of liquid, condensed, and dried buttermilk showed that they contain from 10.9 to 14 per cent of ash on a water-free basis.

Culling the farm flock, H. E. CUSHMAN (*Mont. Agr. Col. Ext. [Pub.] No. 58 (1923), pp. 14, figs. 12*).—Practical instructions are given for culling the flock by means of the physical characters of the hens.

The relative value of the monthly distribution of egg production, M. A. JULL (*Sci. Agr., 3 (1923), No. 8, pp. 276–284, figs. 2*).—This is essentially a discussion of the economics of egg production, based on the feed consumption, egg prices, and egg production of Rhode Island Reds and Barred Plymouth Rocks at Macdonald College, Quebec, from 1918 to 1921.

The monthly feed consumption and costs were approximately equal during the different months, but the egg production and egg prices were variable, making the resulting profit much greater in certain of the months. Attention is called to the fact that egg prices go up in August, but that little effort has been expended in endeavoring to increase the rate of production during this period. Increased production from August to February would include the period of highest prices, but would have to be accomplished by producing birds that would commence laying earlier than at present.

Early laying: Its economic significance, M. A. JULL (*Agr. Gaz. Canada, 10 (1923), No. 3, pp. 244–248, figs. 2*).—The monthly rates of egg production of 411 Barred Plymouth Rocks at Macdonald College, Quebec, are classified according to the months in which they started laying. Those starting in September averaged 153.78±2.13, in October 175.32±1.34, in November 159.71±1.04, and in December 146.18±1.82 eggs annually. The birds starting in October not only laid a larger total number of eggs, but they also laid more during the months of November, December, and January. The author concludes that birds should be hatched to start laying in October, and recommends that egg-laying contests start on October 1 instead of November 1.

Heredity in poultry, R. C. PUNNETT (*London: Macmillan & Co., Ltd., 1923. pp. XI+204, pls. 12, figs. 28*).—The known genetic factors which determine different characters of poultry and their methods of inheritance are discussed on the basis of the more recent experimental results. Chapters are included on such headings as multiple factors, sex-linked inheritance, secondary sexual characters, structural features, plumage color, downs, eggs and broodiness, and linkage. An extensive bibliography is also given.

Canaries: Their care and management, A. WETMORE (*U. S. Dept. Agr., Farmers' Bul. 1327 (1923), pp. II+22, figs. 6*).—This is a revision of Farmers' Bulletin 770 (E. S. R., 36, p. 455) and discusses the principles of care, management, feeding, and breeding of canaries.

Fur farming increasing in Wisconsin (*Wisconsin Sta. Bul. 352 (1923), pp. 80–84, figs. 2*).—A survey by F. B. Hadley and B. L. Warwick of the fur farming industry in Wisconsin showed that it is increasing. The chief animals raised on fur farms are the foxes, but a few farmers also raise skunks, minks, raccoons, wolves, and rabbits. The difficulties encountered and the methods of laying out farms are discussed, with suggested methods for the management and feeding of foxes and prevention of diseases.

DAIRY FARMING—DAIRYING.

Noteworthy events in the world's dairy industry, 1922, T. R. PIRTLE (*Jour. Dairy Sci., 6 (1923), No. 2, pp. 150–153*).—The author summarizes the principal events of the world's dairy industry during 1922 as indicating progress in three lines: "Better quality of products, closer grading and inspection, and more complete organization, making possible adjustment of production to market demands."

Dairying in Vermont in the seventies and eighties, J. L. HILLS (*Jour. Dairy Sci., 6 (1923), No. 2, pp. 87–94*).—This is an historical review of dairying in Vermont with special reference to the period 1870–1880.

Feeding dairy cows, G. C. HUMPHREY and F. B. MORRISON (*Wis. Agr. Col. Ext. Spec. Circ., May, 1923, pp. 73, figs. 9*).—The principles of feeding dairy cows and directions for balancing rations, purchasing feeds, etc., are given.

A factor causing the assimilation of calcium, C. H. HUNT and A. R. WINTER (*Science, 57 (1923), No. 1486, pp. 717, 718*).—The inability of lactating cows and goats to maintain a calcium balance on rations of timothy hay and grain is noted (E. S. R., 47, p. 873), and the results of an experiment carried on at the Ohio Experiment Station are reported.

Two milking goats were fed for three test periods of 7, 7, and 12 days, respectively, on a ration of timothy hay and grain with the addition of a starch paste made up of a known solution of $CaCl_2$ and an equal volume of Na_3PO_4 of the same strength. The product formed was then $Ca_3(PO_4)_2$, which was held in a highly dispersed form by the starch acting as a protective colloid. The goats used in the test were in the third and fifth months of lactation and were receiving from 5 to 6 gm. of calcium in the form of a paste per day. Positive calcium balances were maintained during 5 of the 6 test periods, and the negative balance was only 0.32 gm. of calcium for the other (12-day) period.

The authors conclude that a vitamin may play an important part in calcium assimilation, but the difference between green and dry plants in causing the assimilation of calcium is believed to be partly due to the physical properties of the cell walls and the cells of the plants.

Apple by-products as stock foods, G. P. WALTON and G. L. BIDWELL (*U. S. Dept. Agr. Bul. 1166 (1923), pp. 40, fig. 1*).—A compilation from the literature of the analyses of apple pomace, apple-pomace silage, and apple-pectin pulp is given, and the processes of manufacturing each product are described. The comparative analyses of dried apple pomace, dried apple-pectin pulp, corn silage, and dried beet pulp, as determined by the authors and colleagues, are given. The coefficients of digestibility of apple pomace are summarized from the literature and compared with corn silage. The literature dealing with the feeding value of dried apple pomace and dried apple-pectin pulp is reviewed and the

results of experiments carried on to determine the value of dried apple pomace and dried apple-pectin pulp for milk production are reported.

By replacing the corn silage in the ration of a Holstein cow with dried apple pomace moistened with 3 parts of water it was found that the cow produced 16.5 lbs. more milk during a 30-day period than were produced in the average of the previous and following 30-day periods when corn silage was fed. Transition periods of 10 days each were allowed for changing the rations. Equivalent amounts of grain and hay were fed in the different periods, and the apple pomace supplied practically the same amount of dry matter as was present in the corn silage. In a similar trial with apple-pectin pulp a cow's milk production was increased 14.4 per cent and her fat production 7.1 per cent.

In a short palatability test 4 cows were fed for 5 days, 1 cow consuming as high as 14.5 lbs. of dried pulp or 58 lbs. of moistened pulp in a day without bad effects. For a further test 6 Holstein cows were divided into 2 lots and the comparative value of dried beet pulp and dried apple-pectin pulp for milk production was determined by the double reversal method of feeding. Both feeds were soaked between feedings with 3 parts of water. The feeding periods were 30 days in length, with 10-day transition periods, and the balance of the rations were the same except for slight variations in yield. The cows receiving beet pulp produced 4,976.5 lbs. of milk and 171.86 lbs. of butterfat and gained 109 lbs. in weight, whereas the cows receiving pectin pulp produced only 4,375.7 lbs. of milk and 152.93 lbs. of butterfat, with a loss of 67 lbs. in live weight. In this test there was also evidence of a lack of palatability of the pectin pulp.

For practical feeding of the apple by-products the authors suggest the necessity of thorough cooking to destroy the emulsin which may produce hydrocyanic acid from a cyanophoric compound, amygdalin, which is present in the apple seeds. Where the apple seeds are removed during the process of manufacture this precaution may not be necessary. The bibliography includes 144 references.

The optimum quantity of skim milk for calf feeding, T. E. Woodward (*Jour. Dairy Sci., 6 (1923), No. 3, pp. 243, 244*).—To study the effect of feeding different amounts of skim milk to calves, lots of 4 calves each were fed skim milk, at the U. S. D. A. Dairy Division Experiment Station at Beltsville, Md., in daily amounts of one-fifth, one-sixth, and one-seventh of their body weight, and another lot received all the skim milk they would drink twice daily. The test lasted 70 days. The lot receiving all they would drink made the largest average gains, 103.7 lbs., followed in order by the other lots receiving the most milk. The calves receiving the least milk, however, made the most economical gains according to the amount of milk required to produce 1 lb. of gain.

No bad results from heavy feeding were noticed, though 3 of the 4 calves in the lot receiving all they would consume drank over 40 lbs. of skim milk a day during some parts of the test.

Raising dairy steers, C. C. Hayden (*Ohio Sta. Mo. Bul., 8 (1923), No. 5–6, pp. 84, 85*).—The history and cost of the dairy steers previously mentioned (E. S. R., 48, p. 670) before they were placed in the feed lot are given, and it is shown that they were produced at a loss. This may have been partly due to the fact that they were originally fed for breeding purposes, and the costs were, therefore, greater than they would have been had the calves been intended for the feed lot from birth.

Inheritance of milk and meat production in cattle (*Wisconsin Sta. Bul. 352 (1923), p. 27*).—In experiments to study the transmission of milk and meat production, crosses between Jersey and Angus and Holstein and Angus cattle have been made by L. J. Cole. The polled condition and the black color of the Angus are dominant in both cases. The Holstein-Angus calves are meaty animals and make good veal or young beef.

Comparative talent of Gold Medal sires, P. A. Berry and C. W. Turner (*Jersey Bul. and Dairy World, 42 (1923), No. 21, pp. 1043, 1044, fig. 1*).—The average production of the daughters of Gold Medal sires are compared with the average production of their dams. To give the sires an equal chance, it is suggested that a sire's capacity to transmit milk production be taken as twice the difference between the daughter's record and one-half the dam's record.

Contribution toward defining the correlation between milk and fat (Friesian cows), Z. Moczarski (*Rocz. Nauk Rolnicz., 9 (1923), No. 1, pp. 90–94*).—In a study at the Zoological Institute of the University at Posen, Poland, a correlation coefficient of -0.118 ± 0.024 was obtained between the milk production and butterfat percentages of 749 West Friesian cows.

Studies in milk secretion.—X, Relation between the milk yield of one lactation and the milk yield of a subsequent lactation in Guernsey advanced registry cattle, J. W. Gowen (*Jour. Dairy Sci., 6 (1923), No. 2, pp. 102–121*).—A complete report of the study noted from an abstract (E. S. R., 48, p. 478).

Seasonal variations in milk and fat production, C. W. Turner (*Jour. Dairy Sci., 6 (1923), No. 3, pp. 198–204, figs. 3*).—Essentially the same material was previously noted (E. S. R., 49, p. 173).

Departmental committee on distribution and prices of agricultural produce.—Interim report on milk and milk products, Linlithgow et al. (*London: Min. Agr. and Fisheries, 1923, pp. 110, figs. 4*).—This is the report of the committee appointed by the Minister of Agriculture and Fisheries to investigate the methods and costs of selling milk and its products in Great Britain.

A study of determining solids-not-fat in cow's milk, B. Masurovsky (*Jour. Dairy Sci., 6 (1923), No. 2, pp. 145–149, fig. 1; also in Cream. and Milk Plant Mo., 12 (1923), No. 6, pp. 54, 55*).—After studying the data presented by Shaw and Eckles (E. S. R., 25, p. 112), the author finds that the percentage of solids-not-fat as determined by the Babcock formula differs slightly from the chemical determinations. He therefore suggests either of the following formulas for giving results closer to the chemical analysis:

$$\text{S. N. F.} = (L/4 + 0.2\ f) \times 0.9922$$
$$\text{or S. N. F.} = (L/4 + 0.2\ f) - 0.0604,$$

in which L=lactometer reading in Quevenne degrees and f=percentage of butterfat.

High quality milk shut out by laboratory tests (*Wisconsin Sta. Bul. 352 (1923), pp. 79–80*).—Tests of certified milk rejected from Chicago because of the presence of hemolytic streptococci were made by W. D. Frost and F. Bachmann, and they found that organisms of the Beta type (associated with streptococcus sore throat) occurred in 15 to 40 per cent of the milk of cows from these herds. Similar organisms were found in the milk of 15 per cent of the animals in the university herd, but there seemed to be no cause for suspecting the safety of the milk from any of these sources.

The alcohol test as a means of detecting abnormal milk, A. C. Weiman (*Jour. Dairy Sci., 6 (1923), No. 2, pp. 95–101, fig. 1*).—Three herds in which the milk from certain cows showed positive alcohol tests when delivered at the Grove City, Pa., creamery (operated by the Dairy Division, U. S. D. A.) have been studied as to the cause of the abnormal milk. Tests for fermentation, bacteria, acidity, and flavor showed no marked abnormalities in any samples of the milk. In all cases moldy silage was being fed at the time this milk was produced, and only part of the cows in each case were eating it. The milk

from those showing the negative alcohol reaction was from the ones that had refused the moldy silage. When silage feeding stopped the milk became normal in a few days.

In the third herd three cows were selected and fed experimentally for 14 days. Two of the cows stopped producing abnormal milk on the fifth day after the silage was stopped, but one produced abnormal milk on the third day after the silage was started again. One cow fed for the entire 14 days on moldy silage produced abnormal milk throughout, as determined by the alcohol test. Tests were made of the coagulating temperature of the milk of these three cows, and it was 8.5° F. higher when the alcohol test showed negative, but varied 2° or less for different samples from the same cows showing positive tests. The possible use of this test by condenseries for determining the quality of milk to be used in the manufacture of condensed and evaporated milk is noted.

A ropy milk organism isolated from the Finnish "Piima" or "Fiili," H. MACY (*Jour. Dairy Sci., 6 (1923), No. 2, pp. 127–130*).—The morphology and cultural characteristics of an organism isolated at the Minnesota Experiment Station from a Finnish beverage called Piima or Fiili are described. The organism is similar to *Streptococcus lacticus* and *S. taette*, but differs in certain characteristics from them and other organisms causing ropiness in milk. The name *S. piima* is suggested for the organism.

Determination of fatty acids in butter fat, II, E. B. HOLLAND ET AL. (*Jour. Agr. Research [U. S.], 24 (1923), No. 5, pp. 365–398*).—The results are reported from the Massachusetts Experiment Station of a chemical study of the composition and fatty acid content of the butterfat from the milk of a mixed herd of grade Holsteins and Jerseys on normal rations; from the milk of individual records of 2 grade Holsteins and 2 grade Jerseys early in lactation on normal rations; individual records of 2 grade Holsteins and 2 grade Jerseys early, intermediate, and late in lactation when fed normal rations; and individual records of 2 grade Holsteins with and 2 grade Holsteins without the addition of 0.75 lb. of coconut fat, peanut oil, corn oil, or soy bean oil to the normal daily ration. The results are given in detail. The methods employed in making the chemical tests have been previously described (E. S. R., 39, p. 15).

In comparing the fatty acids in the butterfat produced by grade Holsteins and grade Jerseys the authors concluded that the total fatty acids in the butterfat were substantially the same, but the neutralization number of the total fatty acids, the amount of free fatty acid, the soluble fatty acids, the neutralization number of the insoluble fatty acids, percentage of glycerol, and butyric, caprylic, myristic, palmitic, and stearic acids were lower in the Holstein butterfat, while the percentage of insoluble fatty acids and caproic, capric, lauric, and oleic acids were higher.

With advances in the stage of lactation, the percentage of total fatty acids and insoluble fatty acids increased, though the neutralization numbers of the total fatty acids and insoluble fatty acids and the percentage of soluble fatty acids and glycerol decreased. Adding fats and oils to the rations increased the insoluble fatty acids, which was reflected by an increase in the total fatty acids and a decrease in the soluble fatty acids. The peanut, corn, and soy bean oils decreased the neutralization numbers of all the fatty acids, but coconut fat increased the neutralization number of the insoluble fatty acids.

The results of the analyses are summarized for the cows receiving normal rations, and the relation of the work of other investigators to these results is discussed.

[Experiments in dairying at the Wisconsin Station] (*Wisconsin Sta. Bul. 352 (1923), pp. 79, 88–90, 92, fig. 1*).—The results of experiments in the production of Swiss cheese and butter are reported.

"*Stinker*" *Swiss cheese increasing.*—In studying the cause of the occurrence of "stinker" Swiss cheese, E. G. Hastings and W. C. Frazier have found large numbers of butyric acid-forming bacteria in the spoiled areas. These bacteria seem to grow in the presence of considerable amounts of acid.

Better methods important in Swiss cheese making.—The use of an egg incubator lamp and regulator, or a double-walled container, for growing at the proper temperature starter used in making Swiss cheese, is suggested by J. L. Sammis.

Trials with eye culture.—Eye-forming culture for Swiss cheese as developed and distributed by C. M. Gere of the Dairy Division, U. S. D. A., has been found to give Swiss cheese the desired flavor when intelligently used.

Fishy flavor of butter.—H. H. Sommer and B. J. Smit have determined that the fishy flavor of stored butter is due to the presence of trimethylamin or its salts. It may be formed by the decomposition of lecithin, which is favored by a high acidity and high salt content of the butter, combined with oxidation resulting from overworking in the presence of metallic utensils.

Condensed and dried milk, J. Hansen (*Maanedsskr. Dyrlaeger, 35 (1923), No. 6, pp. 145–169*).—This is a discussion of the methods of production and the composition of condensed and dried milk.

A study of the use of superheated and unsuperheated plain condensed bulk skim milk in the manufacture of ice cream, P. H. Tracy (*Jour. Dairy Sci., 6 (1923), No. 3, pp. 205–221, figs. 4*).—Previously reported (E. S. R., 48, p. 673).

VETERINARY MEDICINE.

Mechanical injury to livestock resulting from wire or poverty grass (Aristida longiseta), G. W. Stiles, jr. (*North Amer. Vet., 4 (1923), No. 7, pp. 360–365, figs. 7*).—The author reports observations of mechanical injury to livestock by *A. longiseta* in eastern Colorado.

Etiology of spontaneous ulcer of stomach in domestic animals, E. C. Rosenow (*Jour. Infect. Diseases, 32 (1923), No. 5, pp. 384–399, figs. 10*).—The studies here reported have led to the following conclusions:

"Streptococci were isolated consistently in pure cultures or in predominating numbers from a series of ulcers in the hog, calf, cow, sheep, and dog. This organism was demonstrable in the tissues, and the number was roughly proportional to the acuteness of the condition. There was an increasing incidence of pure cultures in the tissues as the distance from the source of contamination, the ulcerated surface, increased. Ulcer, hemorrhage, and infiltration of the stomach were produced in 86 per cent of rabbits and dogs injected with the freshly isolated cultures from ulcers in the different species, often with no lesions elsewhere. Similar results were obtained with cultures of the streptococcus from the infected tonsils in the cow and dog that had ulcer. The streptococcus was demonstrated in, and isolated from, experimentally produced ulcers when other tissues were sterile, and produced ulcer on reinjection. Specific localizing powers were retained for 7.5 years in two of three strains preserved in ascites-glucose-agar shake cultures, layered with oil.

"Results such as these have not been obtained with streptococci of similar morphology from sources other than ulcer. Ulcer of the stomach in animals, as in man, is apparently due to localized blood-borne infection by streptococci having selective affinity for the mucous membrane or other parts of the stomach."

The differentiation of the bacilli of blackleg and similar organisms by a complicated animal test, V. GOERTTLER (*Ztschr. Immunitätsf. u. Expt. Ther., I, Orig., 36 (1923), No. 5–6, pp. 463–481*).—The author discusses the literature on various methods of differentiating blackleg from other similar pathological conditions, such as malignant edema. In his opinion both cultural and immunization tests are absolutely necessary for the correct diagnosis. Of the two, immunization of guinea pigs against the toxin to be tested and subsequent infection with pure cultures is considered of even greater value than the determination of the morphological and cultural characteristics of the organism. The method employed in conducting these tests is described, and data are given on the application of the method.

Blackleg vaccines: Their production and use, J. P. SCOTT (*Kansas Sta. Tech. Bul. 10 (1923), pp. 3–24*).—This publication includes a brief historical introduction in which the development of different methods of vaccination against blackleg is traced briefly; a description of the disease as to its occurrence, mortality, etiology, symptoms, and post-mortem findings; and a detailed discussion of the prevention of the disease by the use of powder vaccine, antiblackleg serum, blackleg aggressin, and blackleg filtrate. The preparation and method of application of each of these vaccines is described, and data are presented on the immunity secured by each.

Preventive treatment by early injection of blackleg filtrate or aggressin is considered the most satisfactory method of immunization. In districts where the presence of infection is suspected, it is recommended that all calves be vaccinated before 6 months of age and revaccinated within another 6 months. The immunity secured by both products is of high degree, but since it does not develop for from 3 to 10 days after injection, it is considered advisable, if losses have occurred before treatment has been begun, to give all of the animals a preliminary treatment with blackleg serum, followed in from 10 to 12 days with the filtrate or aggressin.

It is stated that losses before any vaccination was practiced ranged from 3 to 25 per cent of all young cattle in affected districts in the West and Southwest, and that losses after powder vaccination was introduced were reduced to nearly 1 per cent, and after filtrate or aggressin vaccination to less than 0.01 per cent.

The trypanocidal effect of Bayer 205 on Trypanosoma equiperdum, K. HESSELBACH (*Centbl. Bakt. [etc.], 1. Abt., Orig., 89 (1922), No. 4–5, pp. 48–71, pl. 1, fig. 1; abs. in Trop. Vet. Bul., 11 (1923), No. 1, p. 5*).—The author finds that a 1 per cent solution of Bayer 205 produces little effect in vitro. The effects become more marked with increased concentrations, a 7.5 per cent solution rendering trypanosomes motionless in from 25 to 60 minutes, and a 10 per cent solution produces a similar effect in 5 minutes. The drug leads to a breaking up of the nucleus, its fragments being scattered throughout the cytoplasm. Subsequently the body becomes swollen, the undulating membrane and flagellum become altered, and trypanolysis occurs.

A new serum reaction for the diagnosis of tuberculosis, L. BONACORSI (*Ztschr. Immunitätsf. u. Expt. Ther., I, Orig., 36 (1923), No. 5–6, pp. 531–533*).—A serological method is described for the detection of tuberculosis by means of an alcoholic extract of tubercle bacilli treated with cholesterol. In testing this method on the sera of 150 tuberculous patients, positive results were obtained in 92.5 per cent. In 88 per cent the results agreed with those obtained by the complement fixation method of Besredka.

The infection of calves with abortion bacilli present in the milk of infected cows, J. QUINLAN (*Arch. Wiss. u. Prakt. Tierheilk., 49 (1923), No. 4–5, pp. 192–242; abs. in Jour. Compar. Path. and Ther., 36 (1923), No. 2, pp. 129–*

133).—"It has been ascertained by agglutination tests that antibodies specific for the *Bacterium abortus* sometimes appear in the blood of calves which have been fed with infected milk. The agglutination titer is never very high except in calves which are out of infected mothers and which already show antibodies in their blood at the time of birth. The antibodies which appear in the blood, whether as a result of feeding with infected milk or in consequence of intrauterine infection, do not persist permanently. They disappear either during the period of feeding with infected milk or when the feeding with the infected milk is stopped. If antibodies are present in the blood serum of a newborn calf, they may increase in amount for a short time even when the animals are not fed with infected milk. One may without hesitation allow calves to be fed with naturally infected uncooked milk until they are six or seven months old without any danger that they will become chronic carriers of the disease. Provided the calves are strong and healthy at the time of birth, feeding them with milk containing abortion bacilli has no bad influence on their general health."

Hypertrophy of the hemolymph nodes in Texas-fever immunes, A. S. WARTHIN (*Jour. Infect. Diseases, 32 (1923), No. 5, pp. 333–340, pls. 4*).—Studies here reported upon have been summarized by the author as follows:

"In many Texas-fever immunes there occurs a very marked generalized hypertrophy of the hemolymph nodes, which is to be interpreted as a manifestation of protective reactions against a latent infection. Inasmuch as Meyer[1] has emphasized the involvement of the hemolymph nodes in East Coast fever, there appears to be a special predilection for these organs in piroplasma infections."

Calf diphtheria or stomatitis in Wisconsin (*Wisconsin Sta. Bul. 352 (1923), p. 88*).—It is stated that necrotic stomatitis of calves, due to *Bacillus necrophorus,* has been discovered by F. B. Hadley.

Goiter in calves and sheep prevented by iodin (*Wisconsin Sta. Bul. 352 (1923), pp. 84, 85*).—It is pointed out that cases of goiter in calves have been reported from numerous places in Wisconsin, and a survey by F. B. Hadley shows that the disease confines itself to certain herds rather than to any particular part of the State. "As a method of prevention of goiter in calves, it is recommended that 5 gr. of potassium iodid (KI), or sodium iodid (NaI), be given to each cow every second day during the last three months of the gestation period. This may be conveniently given by placing a 5-gr. tablet in the drinking cup or by dissolving the iodid crystals in water and then mixing with the feed or the drinking water. This method of treatment is also recommended for sheep, the dose being 5 gr. per week by mixing it with the salt."

Bacteriologic study of pneumonia in sheep, R. S. SPRAY (*Jour. Infect. Diseases, 33 (1923), No. 1, pp. 97–112*).—"A detailed bacteriologic study is reported of two types of pneumonia in sheep under slaughterhouse conditions: (1) A rather edematous type frequent in spring lambs, (2) a purulent, chronic type found only in older sheep, and often associated with lesions of caseous lymphadenitis (pseudotuberculosis).

"*Pasteurella ovisepticum* was isolated in mixed culture from four cases of the lamb type and in pure culture from a castration abscess in a lamb. It was isolated in pure culture in one case and in mixed culture in five cases in the older sheep. Two groups of organisms apparently closely related to each other, and very similar to the true pasteurella type, were frequently isolated in pure or mixed culture from lambs and once from old sheep in mixed cul-

[1] Rpt. Govt. Vet. Bact. Union So. Africa, 1909–10, pp. 56–68; Proc. Path. Soc. Phila., n. ser., 14 (1911), No. 2, pp. 52, 53.

ture. These two types may be separated by a slight difference in growth in glycerol and by the results of the direct agglutination and absorption tests. They may be separated from the true pasteurellas by their action on blood agar, maltose, and glycerol. Intermediate strains were isolated which seemed to connect these two types (S3 and S14) together and to the true *P. ovisepticum*.

"Agglutination and absorption tests, while unsatisfactory, due to certain technical difficulties, seem to support this idea of the relationship of these strains. A gram-positive diplococcus was isolated a number of times from suppurative pneumonia associated with lesions of caseous lymphadenitis in older sheep. This organism has certain outstanding characteristics which sharply separate it from the common infectious streptococci, the most striking being its proteoclastic activity on milk, gelatin, and blood serum. A gram-negative diplococcus of the *Micrococcus catarrhalis* type was isolated in pure culture from two cases of pneumonia in lambs, in mixed culture from six more cases, and from two cases of penumonia in the older sheep in mixed culture.

"The pathogenicity tests showed the true *P. ovisepticum* to be highly pathogenic for mice, guinea pigs, and rabbits. The two types (S3 and S14) described as being similar to the pasteurella type are likewise highly pathogenic for mice and guinea pigs, but less so for rabbits. They are capable of causing a septicemia in which the organisms can not be microscopically distinguished with certainty from the true Pasteurella. The occurrence of a nonvirulent organism called 'atypical *Bacillus ovisepticus*' is reported by L. T. Giltner, and a culture of this strain was identical in its cultural reactions with the S3 type isolated in the course of this study. These two strains cross-agglutinated to the full serum titer, and mutually cross-absorbed agglutinins."

Some points relating to the morphology and development of Sarcocystis tenella, J. P. McGowan (*Parasitology, 15 (1923), No. 2, pp. 139–150, figs. 2*).—"A short description is given of an important disease of sheep (scrapie, traberkrankheit, la tremblante) believed to be caused by a heavy infection with *Sarcocystis tenella*, probably of increased virulence. The itchiness and paresis, the congenital transmission by the mother, the noncontagiousness, the long incubation period, etc., are readily explained on this view, and a method of control of the disease based on this theory has been highly successful. The sarcocyst has been shown to be transmitted from sheep to sheep by intrauterine infection and by means of the milk. The minute structure of the sarcocyst is described, and it has been shown in particular that the sickle-shaped spores are surrounded by a capsule. Under certain conditions, as in 1 per cent glucose water and in the center of the ripe cyst, these spores swell out and become globular, eventually bursting and scattering small chromatin granules. The further evolution of these granules is dealt with. The spread by means of milk and by the intestinal route is discussed."

A bibliography of 26 titles is included.

Bacillary dysentery in lambs: A note on some recent research into the etiology and source of infection, S. H. Gaiger and T. Dalling (*Jour. Compar. Path. and Ther., 36 (1923), No. 2, pp. 120–125*).—Investigations here reported, in continuation of those previously noted (E. S. R., 46, p. 776), have led to the following conclusions:

"An anaerobe of the *Bacillus welchii* type and a bacillus of the *B. coli* type, acting conjointly, are responsible for the production of lamb dysentery. Ingestion during or after birth is the route of infection. The soil becomes infected and can harbor the anaerobe at least from year to year. Lambs may ingest the causal organism from the surface of the ewes' teats, soiled either by vaginal or fecal discharges or contaminated by contact with the soil, or they may pick

up infection direct from the soil or by actual contact with affected lambs. Every case of the disease is a source of real danger to the healthy lambs, because of the fact that lambs can become infected by ingesting the intestinal contents of the affected, and it behooves farmers who are in danger of getting dysentery amongst their lambs to watch carefully for the first cases and destroy them and all infection ruthlessly."

A study of the growth of the hoofs of native horses, M. D. SUMULONG (*Philippine Agr., 11 (1923), No. 8, pp. 235–242*).—"The average growth of the hoof of native horses is 9.25 mm. per month. Excessive amount of moisture has no effect on the rate of growth, but what the hoof requires for maintaining its normal growth is that quantity of moisture just sufficient to keep its normal elasticity and yielding character. Unshod hoofs grow somewhat faster than shod. Posterior hoofs grow more rapidly than anterior. The rate of growth of the wall of the hoof is almost regular around the coronet. Apparently age, sex, color, and size of the animal have no connection with the rapidity of growth of the hoof."

The blood of equines, C. P. NESER (*So. African Jour. Sci., 19 (1922), pp. 244–253, figs. 4*).—The author's studies here reported have been summarized as follows:

"Erythrocyte counts of healthy horse blood are much increased by regular fast work. Diurnal variations in erythrocyte count of horse blood are due to mechanical changes in the circulation influencing the distribution of the cells. Leucocyte count is not influenced by regular exercise, but during exercise the count increases for jugular blood. In taking blood by puncture, the technique is all important, and, by varying this, widely different data may be obtained. Comparative data for the blood of horses, donkeys, and mules are offered."

Experiments on the disinfection of sperm in mammals, especially in relation to dourine in horses, E. IWANOW (*Parasitology, 15 (1923), No. 2, pp. 122–127*).—"The results herein recorded show that it is possible to disinfect sperm without diminishing its potency . . . . They show that salvarsan and neosalvarsan in 1:10,000 dilution render *Trypanosoma equiperdum* uninfective in 15 minutes, whereas they exert no appreciable effect on spermatozoa in two hours. As a means of preventing infection with dourine amongst stallions in regions where this disease is prevalent, we recommend, prior to coitus being allowed, that the vagina of mares be washed with physiological salt solution containing salvarsan (arsol, arsaminol) or neosalvarsan 1:10,000, and that the penis of stallions be washed with an aqueous solution of the same strength after coitus. For the eradication of the disease in localities where dourine is widely distributed, it is useful to substitute for the natural covering of mares artificial insemination, having recourse in any doubtful case to disinfection of the sperm by adding to the latter a solution of salvarsan or neosalvarsan in the above-named concentration.

"As a prophylactic measure it may be useful to employ an ointment containing salvarsan 1:10,000. The ointment should not contain mercury compounds, to which spermatozoa are very sensitive. The anointing of the stallion's penis will serve to lessen friction during coitus, thereby decreasing the extent of the abrasions which serve as ports of entry for infection. Moreover, the ointment may lower the infectivity of the trypanosomes with which it comes in contact.

"The observation that *T. equiperdum* lose their infective power under the influence of weak solutions of salvarsan and neosalvarsan without losing their vitality is of interest. The peculiar behavior of the trypanosomes in this

respect suggests that it may afford a means of producing active immunization against dourine."

A discussion of the factors concerned in the etiology of equine influenza and contagious pneumonia, R. A. KELSER (*Jour. Amer. Vet. Med. Assoc., 63 (1923), No. 2, pp. 162–169*).—This is a summary of the status of knowledge of the subject presented at a conference of veterinarians at Philadelphia, in February, 1923.

Resistance of the virus of equine infectious anemia to carbolic acid, E. FRÖHNER and K. BIERBAUM (*Berlin. Tierärztl. Wchnschr., 39 (1923), No. 22, pp. 243–245*).—It was found that the virus of infectious anemia in serum from an infected animal is destroyed by a 0.5 per cent solution of carbolic acid after a period of 90 days.

Danger lies in feeding horses silage (*Wisconsin Sta. Bul. 352 (1923), pp. 87, 88*).—The symptoms observed by F. B. Hadley in horses suffering from silage poisoning are described.

Parasitic infestation of dogs before birth, J. E. SHILLINGER and E. B. CRAM (*Jour. Amer. Vet. Med. Assoc., 63 (1923), No. 2, pp. 200–203*).—The work reported is said to confirm Fülleborn's findings[1] as to the possibility of prenatal infestation with *Belascaris marginata*, and establishes the fact that following ingestion of infective Belascaris eggs by pregnant animals, the larvae in the course of their migration may cross the placenta and enter the young in utero.

Internal parasites of dogs and cats in the United States and treatments for removing these parasites, M. C. HALL (*Jour. Amer. Vet. Med. Assoc., 63 (1923), No. 1, pp. 11–51, figs. 25*).—In this paper, which was presented at the fifty-ninth annual meeting of the American Veterinary Medical Association, held at St. Louis, in August, 1922, the author considers the 47 internal parasites of the dog and cat which have been reported from the United States and its possessions.

A spontaneous disease of chickens and ducks associated with a toxic anaerobe, R. GRAHAM and I. B. BOUGHTON (*Abs. Bact., 7 (1923), No. 1, pp. 29, 30*).—This is the authors' abstract of a paper presented at the annual meeting of the Society of American Bacteriologists, held in December, 1922, at Detroit. It deals with an outbreak of disease among chickens and ducks in Brown County, Ill., caused by an anaerobe distinguished from *Bacillus botulinus* A or B by the character of its growth in liquid or solid media.

Nicotin as a poultry vermifuge, S. B. FREEBORN (*Science, 57 (1923), No. 1485, pp. 692, 693*).—The author reports that work carried on at the California Experiment Station during the past 18 months "with hundreds of hens has shown that commercial tobacco dust containing from 1.5 to 2 per cent nicotin, if fed in the mash in quantities equaling 2 per cent by weight of the latter over a period of one month, would remove from 98 to 100 per cent of [the *Ascaridia galli* Schrank (=*A. perspicillum*)] worms. The results have also demonstrated that from 80 to 85 per cent of the caecum worms, *Heterakis gallinae* Gme. (=*H. papillosa*=*H. vesicularis*) are removed by this treatment. The tobacco dust must be mixed with the mash at intervals not exceeding one week on account of the volatility of the nicotin in the presence of air. Diluted nicotin sulphate administered to the birds directly in quantities sufficient to remove the worms is decidedly toxic."

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[1] Arch. Schiffs u. Tropen Hyg., 25 (1921), No. 12, pp. 367–375.

RURAL ENGINEERING.

Economic advantages of concrete lining of canals and laterals on the Orland project, California, R. C. E. Weber (*Reclam. Rec.* [*U. S.*], *14* (*1923*), *No. 5, pp. 172–174, figs. 4*).—Data on the cost of concrete lining and reduction in water losses resulting therefrom on the 79.8 miles of canals and laterals on the Orland project are briefly presented. A material reduction in seepage and evaporation losses, amounting to as much as 90 per cent in sand and gravel sections, was possible by the application of concrete lining to the earth section. Another important factor which developed in favor of the concrete-lined section over the unlined channel in earth was that of the increased degree of operating safety as a result of the comparative freedom from washouts and breaks.

Comparative costs on maintaining earth and concrete-line sections covering a season's work of cleaning 66 miles of the former and 31 miles of the latter showed that it cost $55.70 per mile for earth and $19.50 for concrete-lined sections. This amounts to a reduction of 65 per cent in the maintenance cost of earth laterals resulting from the use of concrete lining.

The cost for all concrete lining placed on the distribution system of the project was 38.9 cts. per square yard for 755,400 square yards placed on the 79.8 miles of canals and laterals with capacities varying from 10 to 225 sec.-ft.

New charts for calculating pipe sizes for water flow, F. E. Giesecke (*Heating and Ventilating Mag., 20* (*1923*), *No. 5, pp. 46–51, figs. 9*).—Graphic data for calculating pipe sizes for water flow are presented, based on tests conducted at the University of Texas. Examples demonstrating their use are also included.

Surface water supply of the North Atlantic slope drainage basins, 1919–1920 (*U. S. Geol. Survey Water-Supply Paper 501* (*1923*), *pp. 330, pls. 2*).—This report, prepared in cooperation with the States of Maine, New Hampshire, Vermont, Massachusetts, Connecticut, New York, and Pennsylvania, present the results of measurements of flow made on streams in the North Atlantic slope drainage basins during the years ended September 30, 1919, and 1920.

Comparison of cost of tile drainage and value of improved farm lands in Minnesota, H. B. Roe (*Agr. Engin., 4* (*1923*), *No. 5, pp. 67–70, figs. 3*).—In a contribution from the Minnesota Experiment Station, construction and cost data from 15 farm drainage projects in Minnesota, representing 10 major soil types or combinations thereof and covering a period of activity of 15 years, are summarized and discussed. The tile sizes varied from 4 to 22 in., and the depth of trenches was for the most part 4 ft. or less.

While the data, although covering a long period of time, are not considered sufficient to justify the drawing of final conclusions, they are taken to indicate that the average Minnesota farm under cultivation before artificial drainage is installed tends to include areas that are entirely waste due to lack of drainage, amounting to upwards of one-fourth of their entire area. The tendency of this condition is to raise the normal value per acre of the portion tillable before artificial drainage to an abnormal figure, nearly 50 per cent above the general flat valuation before drainage. Drainage of the waste spots, which will generally bring under cultivation all the land within the present limits of the farm, can frequently be done at a cost per acre not greater than two-thirds of the flat value per acre of the undrained farm and therefore considerably less than one-half the resultant value per acre of the originally tillable land.

[**Drainage studies at the Wisconsin Station**] (*Wisconsin Sta. Bul. 352 (1923), pp. 110–113, fig. 1*).—Studies conducted by E. R. Jones, O. R. Zeasman, C. Helwig, and S. Norling are said to have shown that peat soils with a sandy subsoil can be most easily drained by means of large deep ditches, which may be as much as a mile apart, while shallow ditches are less satisfactory and must, in nearly all cases, be supplemented by tile.

Studies by Jones and Zeasman on draintile showed that the better grades of concrete tile compare favorably with good shale tile. The severest test of tile is where it is placed in peat soils. It is stated that clay or shale tile that absorb water to the extent of more than 14 per cent of their dry weight are undesirable, and concrete tile with an absorption greater than 7 per cent are too porous to be recommended, particularly for use in peat or sand under peat.

Experiences in the first breaking of peat lands, G. R. B. Elliott and J. L. Larson (*Agr. Engin., 4 (1923), No. 6, pp. 83–88, figs. 15*).—In a contribution from the Minnesota Experiment Station the results of experiments on the first breaking of several acres of tamarack swamp drained with tile are presented. The peat on the tract was from 5 to 7 ft. deep and had carried a very heavy growth of trees. Tractors and different types of plows were used in breaking this land.

The most important finding is said to be that a better quality of work was done by the heavier plows, this being later confirmed by the smaller weed growth where the land was deeply plowed. During the summer nettles were plentiful on the shallow plowing. The rolling coulter was not a success on the timbered peat nor on peat containing roots too heavy to cut or so soft that they were easily bent. On open marsh sodded with shallow-rooting small sedges and blue joint grass the 24-in. rolling coulter was a success. The furrow pusher attached to the moldboard of a plow was a distinct success. It did not add as much to the draft of the plow as was expected, and it pushed the newly turned furrow out of the way, permitting the more complete turning of the sod and elimination of top litter.

On the larger plows the drawbar pull was quite constantly near or above 10 h. p., with a reserve up to 17 h. p. drawn upon at times. For the smaller plows the power consumption was above 8 h. p., with a reserve up to 15 h. p. called upon. This is taken to indicate that for marsh breaking a tractor is necessary that is capable of developing not less than 12 working drawbar horsepower with a suitable reserve. Ample support to the tractor proved to be just as important as power. One tractor failed mainly because the special wheel equipment was not available which would enable it to do its work. The most successful tractor had a much larger supporting area, carrying less weight, and the angle lugs were spaced twice as far apart as on the unsuccessful tractor. It had 50 per cent more power in an emergency than the unsuccessful tractor, although it was of a lower rating. Spade teeth lugs served a very useful purpose in catching and holding submerged roots or timber in pulling out of a hole. Heavy skid rings gave the driver control of his machine on soft ground.

The 16-in. plows consumed about as much power per unit of cross sectional area as the 20-in. plows of the same make. Apparent advantages in efficiency developed in one make of plow over another due to differences in the angle between the drawbar and the plow itself. It was established that for ordinary peat breaking the horsepower required can be estimated accurately on the basis of a 5-lb. pull per square inch of furrow slice.

From the standpoint of mere efficiency in turning soil, the cutaway disk loaded to cut 7 in. gave better results than any of the plows, and its power consumption per unit of cross sectional area turned was less than one-half

that of the plows. It is not recommended, however, for first breaking owing to the fact that it required about five passages of the disk to give results equivalent to one plowing. The results are taken to indicate that disk machinery may be extremely efficient for all later cultivation. Good results were also given by the roller.

[Land clearing studies at the Wisconsin Station] (*Wisconsin Sta. Bul. 352 (1923), pp. 113–116, figs. 5*).—Investigations by J. Swenehart and F. W. Duffee, on an improved brush-breaking plow, showed that the chief difficulty with brush-breaking plows is that roots and brush accumulate under the beam and throw the plow out of the ground. It was found that when the beam was offset to the left side of the plow the accumulation of brush, roots, and trash under the beam was greatly reduced and the space directly in front of and above the plow remained relatively free. In trials conducted where poplar, willow, and tag alder brush were heavier than usual, it was found that such growth under 15 ft. high did not cause trouble except when caught squarely on the point of the plow. Data from draft tests are also included.

Investigations on marsh plowing with tractors, by Duffee, showed that the 20-in. plow usually requires a 12 to 15 h. p. drawbar rating in the tractor. Tractors weighing from 4,500 to 6,000 lbs. operated most satisfactorily in practically all cases. It was also found that where wheel tractors are used the rear wheels should be at least 20 in. wide, and angle iron lugs at least 3 in. and preferably 4 in. wide are the most satisfactory. Spade lugs were unsatisfactory.

End bearing strength of wood on surfaces inclined to fibers, H. H. Scofield and E. N. Burrows (*Cornell Civ. Engin., 31 (1923), No. 8, pp. 98–102, figs. 10*).—The results of studies conducted at Cornell University are reported which indicated that the Howe formula for the strength of timber obliquely to the grain conforms more nearly to actual test results than the Jacoby formula. The use of the latter formula in designing joint details would be, in effect, simply an artificial raising of the allowable stresses at all angles. In the case of the hardwoods the results indicated that a formula might be devised which would correspond even more closely than the Howe formula. It was found that the allowable stress for bearing on the ends of the fibers parallel to the grain should be raised to be commensurate with that used when stresses are perpendicular to the grain.

Mechanical tests of some Mysore timbers, J. H. C. Kann (*Jour. Indian Inst. Sci., 5 (1923), No. 14, pp. 209–228, figs. 2*).—The results of transverse, tensile, shear, compression, and density tests of several samples of structural timbers from the Mysore forests are presented and discussed.

Fundamentals of construction and maintenance of secondary type highways, C. C. Albright (*Purdue Univ., Engin. Ext. Serv. Bul. 1 (1922), pp. 36, figs. 33*).—This bulletin briefly describes what is considered to be the best practice in the construction and maintenance of secondary type highways.

Comparative gasoline consumption on different road surfaces, A. B. Cutter (*Munic. and County Engin., 64 (1923), No. 5, pp. 193–195*).—Experiments to determine the gasoline consumption of automotive vehicles on Portland cement concrete, bituminous, and gravel or earth roads are briefly reported.

The distance of each test was 100 miles of continuous operation at a uniform speed of not less than 20 nor more than 30 miles per hour. There was practically no difference in the gasoline consumption on Portland cement concrete and the bituminous roads. The consumption was from 10 to 35 per cent greater on macadam roads in good condition than on either the concrete or bituminous roads.

Palm oil, J. DAUTREBANDE (*Rev. Chim. Indus., 31 (1922), No. 369, pp. 268, 269*).—Chemical studies of palm oil with reference to its use as an internal-combustion engine fuel are briefly reported. They indicated, among other things, that as a fuel palm oil is not dangerous from the standpoint of an explosion owing to its high burning point, and that it is not sufficiently acid to corrode metals appreciably. It is easily transported in semisolid condition and is comparatively cheap.

Efficiency of dust separation in air cleaners for internal-combustion engines, A. H. HOFFMAN (*Agr. Engin., 4 (1923), Nos. 6, pp. 89–95, figs. 11; 7, pp. 109–116, figs. 24*).—This is a complete report of studies previously noted (E. S. R., 48, p. 488), including descriptions of the apparatus and methods of testing.

Dust and the tractor engine, A. H. HOFFMAN (*California Sta. Bul. 362 (1923), pp. 469–486, figs. 8*).—The substance of this bulletin has been covered by the reports noted above.

Tractor cultivation at Lyallpur, Punjab, H. R. STEWART and D. P. JOHNSTON (*Agr. Jour. India, 18 (1923), No. 1, pp. 23–39*).—A summary of experience with tractors at Lyallpur in the Punjab is presented, and data are given on the choice of the proper type of tractor.

The tests have shown that on many occasions where the wheel tractor failed to pull cultivating implements over loose soil the caterpillar tractor did the same work with ease. Many of the wheel types have been observed to require a very large turning area, and for work in small fields the caterpillar is considered to be a much more useful type since it can be turned in its own length. It is concluded that for plowing on hard firm lands the wheel tractor is the better type and in the long run may prove cheaper, while if the work is to be done mainly on light sandy soils or in small areas the caterpillar tractor is the better one to use. Both types have been found to be equally suitable for all kinds of stationary work.

In actual plowing experiments it was found that a wheel type of tractor could not pull a 3-furrow plow if the depth exceeded 5.5 in. When it was desired to plow to a greater depth it was necesary either to use a 2-furrow plow or the 3-furrow plow with the caterpillar tractor. Mainly due to slipping, the wheel tractor was also unable to pull the disk harrow during after-cultivation at the depth required, and this work had to be done with the caterpillar.

Other data and general information on operation and care are presented.

[Mowing machine studies at the Wisconsin Station] (*Wisconsin Sta. Bul. 352 (1923), pp. 116–118, fig. 1*).—Investigations by F. W. Duffee on the influence of worn parts on the draft of a mowing machine showed that a 2-horse mower requires the power of 3 horses when it is extremely dull or when some of the cutting parts are badly worn.

Modern windmill practice (*Impl. and Mach. Rev., 48 (1923), Nos. 757, pp. 1393, 1394; 576, pp. 1511, 1512; 49 (1923), No. 577, p. 85*).—A summary is given of progress in Europe and elsewhere in the design and construction of wind motors, special attention being given to the development of electric power from windmills.

Heat transference and combustion tests in small domestic boiler, J. BLIZARD, W. M. MYLER, JR., J. K. SEABRIGHT, and C. P. YAGLOGLAU (*Jour. Amer. Soc. Heating and Ventilating Engin., 29 (1923), No. 4, pp. 317–343, figs. 17*).—The results of a series of tests made with various fuels with and without secondary air in an investigation of combustion and heat transference in a small domestic boiler are reported.

The trials so far carried out were divided into two series, namely, those in which the fire pot and base only were used, and those in which the fire pot, base,

and dome were used. The first series was run with no secondary air supply, the fire door being sealed tightly. During one half of the second series secondary air was admitted continuously through the slots in the fire door, and during the other half no secondary air was admitted. Each series of trials was carried out with anthracite, coke, bituminous coal, and natural gas as fuels.

The results of the first series showed conclusively that free oxygen finds its way from the ash pit to the stack, and, consequently, that with anthracite and coke the heat lost by not burning carbon monoxid was never over 5 per cent of the calorific value of the fuel. When burning bituminous coal, however, the losses caused by combustible gases, vapors, and soot passing up the stack were fairly high. This is attributed mainly to the fact that since free oxygen is always present in the flue gases, inadequate provision was made for igniting, mixing, and burning the combustibles rising from the fuel bed of the small furnace. One of the dominating factors militating against this is considered to be the low temperature prevailing above the fuel bed. It is considered obvious that the gases and air must be ignited by some hot exposed portion of the fuel bed or mixed with air which is preheated in some way, or that some means be taken to partially reduce the cooling action of the fire pot if the combustible gases are to be burned.

In tests to determine whether admitting further air over the fuel bed would reduce the losses caused by the combustible gases, it was found that when burning coke and anthracite, opening of the air ports gave an efficiency lower than when they were closed. With bituminous coal the admission of secondary air raised the efficiency somewhat at the highest rating, although at the lowest rating the efficiency was lower when admitting secondary air. Firing the fuel by the coking method did not raise the efficiency. These results are taken to indicate that after firing, and particularly after stirring the fuel bed, secondary air could probably be admitted to advantage.

The over-all thermal efficiency with the fire pot alone as the heat absorbing surface varied between 51 and 59 per cent for anthracite and coke, between 33 and 40 per cent for bituminous coal, and between 40 and 57 per cent for natural gas. When the dome was added to the fire pot and the ports in the fire door were kept closed, the efficiency varied between 57 and 60 per cent for anthracite and coke, between 41 and 48 per cent for bituminous coal, and between 55 and 63 per cent for gas. When secondary air was added the efficiency varied between 49 and 58 per cent for anthracite and coke and between 41 and 46 per cent for bituminous coal. The lower efficiency of gas is attributed largely to the comparatively high loss caused by the total heat of the steam formed from the gas which left the boiler with the flue gases.

Plans for small barns, L. J. SMITH (*Washington Col. Sta. Pop. Bul. 123 (1923), pp. 3–26, figs. 26*).—Plans and working drawings showing framing details of small barns adapted to conditions in the State of Washington are presented and discussed.

Farm homes (*Wisconsin Sta. Bul. 353 (1923), pp. 24, figs. 15*).—Plan and elevation drawings of convenient farm homes are presented and discussed in this bulletin.

A graphical cost analysis of cottage building, W. H. WAINWRIGHT ([*Gt. Brit.*] *Dept. Sci. and Indus. Research, Bldg. Research Bd., Spec. Rpt. 6 (1922), pp. IV+6, pls. 20*).—Diagrams are presented and discussed which not only analyze the costs of cottage building in England since 1914, but serve as a set of labor-saving devices for calculating the requirements of men and material in housing schemes. A set of progress diagrams is included.

RURAL ECONOMICS AND SOCIOLOGY.

[**Investigations in agricultural economics at the Wisconsin Station**] (*Wisconsin Sta. Bul. 352 (1923), pp. 92–98, fig. 1*).—A survey of 31 creameries in La Crosse, Monroe, and Vernon Counties, Wis., was carried on for the purpose of determining methods of improving their marketing conditions. A summary is given of their experiences which indicates that federation and better sales service are the first steps toward improvement.

A study of the service relationships between the farmer and the town is being carried on by J. H. Kolb in eastern Dane County, the Elkhorn area in Walworth County, and the Waupaca area in Waupaca County. In one town, with a population of 490 people, 85 different agencies were discovered having direct relations with the surrounding farm population. In another section including six small towns it was found that the farmers furnished about 65 per cent of the patronage for the noncommercial agencies, such as church, school, social, and fraternal organizations, but assumed only about 15 per cent of the leadership.

Certain farms in Walworth County were surveyed under the direction of P. E. McNall to determine the explanation of successes and to learn, if possible, to what extent it is desirable to supplement the dairy with other lines of farming. The well diversified farms, or those having 4 or 5 sources of income of more than $100 each, made considerably more than the poorly diversified ones. As the production per cow increased from an average of 4,625 lbs. in the lowest herd to 8,138 lbs. per cow in the best herd, the average farm income increased from $476 to $1,205. The cost of milk produced in this case decreased $1.19 per hundredweight.

A recent study directed by B. H. Hibbard covering farms in Green, Rock, and Jackson Counties is noted as showing that in all of these counties the owned farms were smaller than the tenant farms. The tenant farms showed the larger proportion of tilled land, while the owned farms had the larger proportion of pasture. It was found that over a period of 10 years 70 per cent of the owned farms had made important improvements at an average value of $1,119, while on the 57 per cent of the tenant farms on which such improvements were made, an average of only $526 was spent. As in other surveys made, it appeared from this one that about 46 per cent of the tenants are relatives of the landlords and in these districts tenancy in most cases is a step toward land ownership.

Cost accounts for six years on some successful New York farms, G. F. Warren et al. (*New York Cornell Sta. Bul. 414 (1923), pp. 5–139, fig. 1*).—Cost accounts were closed in 1919 on 39 farms, some of which were in the hilly regions of southern New York but more in the valleys and level areas, particularly in the western half of the State. In collecting the data which are tabulated and interpreted in these pages, a representative of the college visited the farm and assisted in taking the inventory and in starting the accounts, and in some instances a map of the farm was made at the end of the year. The representative returned and spent one or more days in helping to take the inventory, seeing that all entries were made at the end of the year.

The main topics reported upon here are the development of the work, the education and experience of farm operators, the character of the farms, methods used, capital invested, profits, human labor, horse labor, equipment, real estate costs, general expenses, manure, lime, dairy cattle, poultry, hogs, sheep, the costs of producing crops, and averages for the seven years 1914 to 1920, for which the accounts obtain. A list of published records of farm business operations is given, including 38 titles. The table following presents some of the items included in the summary.

Summary of averages, 1914 to 1920, of cost data from some New York farms.

Item.	1914	1915	1916	1917	1918	1919	1920	Average for 7 years.
Real estate:								
Number of farms	17	45	30	31	28	35	33	.....
Crop acres per farm	108.8	94.4	110.5	104.3	102.9	101.7	104.3	103.8
Value of crop land per acre	$74.09	$67.75	$73.94	$73.77	$81.56	$80.05	$90.15	$77.33
Human labor:								
Number of farms	18	46	31	31	32	38	33	.....
Total hours of labor	8,956	8,424	8,501	8,285	8,870	8,339	8,143	8,503
Hours per person per year	2,975	3,164	3,066	2,948	3,089	3,086	3,058	3,055
Cost per hour worked	$0.25	$0.26	$0.30	$0.36	$0.40	$0.41	$0.44	$0.35
Horse labor:								
Number of farms	18	46	31	31	32	37	33	.....
Total hours worked by horses	5,138	4,988	5,044	4,813	4,767	4,085	3,935	4,679
Hours per horse per year	1,040	1,016	933	922	1,041	895	901	964
Total cost of keeping a horse	$171.67	$168.54	$170.04	$202.61	$255.45	$236.72	$215.34	$202.91
Cost per hour of horse labor	$0.16	$0.15	$0.17	$0.20	$0.23	$0.24	$0.22	$0.20
Equipment: [1]								
Number of farms	18	46	31	31	32	37	33	.....
Average value per farm	$916.96	$799.23	$864.68	$901.56	$996.08	$1,068.82	$1,137.49	$954.97
Annual cost in percentage of value	28.0	27.5	28.5	30.1	33.5	31.8	32.5	30.3
Cows:								
Number of farms	9	26	17	17	18	22	17	.....
Number of cows per farm	16.6	16.9	20.1	22.6	21.5	19.8	17.1	19.2
Cost of human labor per cow	$38.39	$41.78	$43.15	$45.87	$54.30	$62.62	$61.66	$49.68
Cost of horse and equipment labor per cow	$5.07	$5.56	$5.35	$6.77	$6.86	$7.90	$7.68	$6.46
Total cost per cow [2]	$135.15	$140.42	$143.31	$172.44	$208.15	$228.23	$256.15	$183.41
Cost of milk per 100 lbs. sold	$1.75	$2.12	$1.89	$2.40	$3.13	$3.03	$3.67	$2.57
Total returns per cow [3]	$123.72	$117.44	$138.89	$191.48	$211.77	$251.93	$234.64	$181.41
Hay:								
Number of farms	17	45	31	31	31	35	32	.....
Acres grown per farm	41.2	35.1	42.9	36.1	40.5	42.8	37.9	39.5
Yield in tons per acre	1.15	1.31	1.89	1.72	1.56	1.70	1.42	1.54
Cost per acre	$13.75	$15.48	$18.30	$19.31	$23.47	$24.41	$26.52	$20.18
Profit per acre	$1.78	$2.21	$1.39	$8.09	$7.48	$15.20	$2.55	$5.53
Oats:								
Number of farms	13	41	23	24	28	30	29	.....
Acres grown per farm	15.0	13.8	14.2	15.2	14.9	12.1	12.5	14.0
Yield in bushels per acre	27.4	43.9	24.3	35.3	47.9	25.9	42.2	35.3
Cost per acre	$25.74	$28.03	$27.92	$33.19	$41.44	$41.35	$42.36	$34.29
Profit or loss per acre	−$8.66	−$1.97	−$10.23	+$1.06	+$0.02	−$14.20	−$12.92	−$6.70
Corn for grain:								
Number of farms	6	25	10	13	11	8	15	.....
Acres grown per farm	8.2	5.5	7.2	6.4	5.3	8.7	4.7	6.6
Yield in bushels per acre	37.0	26.8	21.1	23.1	31.2	42.0	31.4	30.4
Cost per acre	$41.90	$41.26	$44.96	$52.59	$72.65	$81.74	$67.28	$57.48
Cost per bushel	$0.88	$1.19	$1.77	$1.79	$2.07	$1.74	$1.88	$1.62
Corn for silage:								
Number of farms	11	26	18	18	20	26	25	.....
Acres grown per farm	13.5	12.1	14.7	14.6	12.9	11.0	12.9	13.1
Yield in tons per acre	7.3	7.1	4.9	4.8	6.2	8.1	6.8	6.5
Cost per acre	$37.74	$39.88	$38.05	$45.19	$64.68	$68.22	$62.54	$50.90
Potatoes:								
Number of farms	13	37	24	27	29	30	24	.....
Acres grown per farm	7.0	6.5	5.7	4.9	2.7	3.0	2.4	4.6
Yield in bushels per acre	162.0	77.2	88.0	91.7	137.7	99.5	208.8	123.6
Hours of human labor per acre	98.3	76.4	78.0	88.6	114.3	96.8	117.0	95.6
Hours of horse labor per acre	87.7	73.1	69.0	74.2	91.2	71.9	83.7	78.7
Cost per acre	$74.82	$54.96	$72.04	$106.30	$122.78	$113.93	$168.43	$101.89
Profit or loss per acre	−$25.40	+$9.41	+$80.91	−$15.52	+$16.30	+$52.65	+$1.17	+$17.07
Wheat:								
Number of farms	10	30	20	18	16	24	19	.....
Acres grown per farm	12.4	14.2	11.6	15.2	15.6	14.9	14.9	14.1
Yield in bushels per acre	21.9	28.9	23.7	23.3	20.0	19.0	26.2	23.3
Hours of human labor per acre	21.7	26.1	23.0	25.5	25.5	24.9	23.3	24.3
Hours of horse labor per acre	34.7	35.1	3.15	38.7	40.2	34.5	28.0	34.7
Cost per acre	$28.75	$28.52	$31.44	$37.95	$46.04	$49.41	$51.26	$39.05
Profit or loss per acre	+$1.10	+$5.80	+$11.11	+$14.17	+$1.10	−$2.66	+$8.01	+$5.52

[1] Exclusive of tractors, automobiles, trucks, and some special equipment
[2] Including depreciation, if any.
[3] Including appreciation, if any

The cost of producing maple sirup and sugar on 60 Vermont farms, 1921, M. P. RASMUSSEN (*[Burlington]: Vt. Agr. Ext. Serv. [1922], pp. 7*).—This is a mimeographed report giving with interpretation the complete data that have been summarized in a bulletin previously noted (E. S. R., 48, p. 687).

Cost of producing maple sirup and sugar on 52 Vermont farms in 1922, H. P. YOUNG (*[Burlington]: Vt. Agr. Ext. Serv., [1923], pp. 7*).—A summary is given of data noted above, as well as detailed costs, including marketing in 1922 and the sales of sirup and sugar, with prices received.

Commodity prices and farming policy, C. S. ORWIN (*Jour. Roy. Agr. Soc. England, 83 (1922), pp. 3–14, pls. 3, fig. 1*).—This is a discussion of increasing costs per unit of return and the conflict between the interest of the farmer and of the individual worker with that of the community in determining the proportions between grass and arable farming in England. It is held that "high farming" is justified only in times of high prices and that the remedy for low prices is the reduction of costs and output.

Simple farm bookkeeping for income tax purposes, C. C. CATTERMULL (*Seale-Hayne Agr. Col. Pamphlet 8 [1923], pp. 15*).—A simple method of keeping accounts is suggested, which requires a diary and an analysis cashbook, and an example is worked out in illustration.

Farm stock-taking, J. M. ADAMS (*Ireland Dept. Agr. and Tech. Instr. Jour., 22 (1923), No. 4, pp. 360–371*).—Brief notes are given on the valuation of livestock, machinery and implements, crops, and the tenant's interest.

The maintenance of the agricultural labor supply during the war, A. SKALWEIT (*Internatl. Inst. Agr. [Rome], Internatl. Rev. Agr. Econ., 13 (1922). No. 12, pp. 836–890*).—These pages present a brief résumé of the numbers and classes of agricultural laborers in Germany before the war. Calculations are made of the number called to the army from agricultural regions, and the means adopted for maintaining production are described in detail.

The Government was able to make use of the migratory labor retained in Germany or recruited in the occupied territories and large numbers of prisoners of war. Furthermore, the military authorities granted leave liberally for periods of intensive farm work, and the town population and women, boys and girls, and the aged exerted themselves to the utmost.

The development of wages payment in Rhenish agriculture (*Landw. Jahrb., 57 (1922), No. 4, pp. 435–537, figs. 4*).—This paper is presented in two parts.

I. *Wages forms,* G. Münchmeyer (pp. 437–465).—This investigation was begun in 1912. An extensive bibliography had been assembled and much first-hand historical information had been gathered from old farm record books and labor contracts when the war cut off the work. The various classes of native, foreign, and seasonal farm workers and the numbers prevailing by districts and by types of farming are traced in detail.

II. *The development of wages,* H. Spaetgens (pp. 466–537).—The author of this section carried out the project noted above. A short bibliography is included in addition to the one prepared earlier.

The discussion is prepared in three parts, the first describing the wages in kind and other payments made to farm workers of the various classes, estimating the value of board and lodging and clothing furnished, and tracing historically the tendency toward the elimination of payment in kind. The second section discusses the related questions, such as the relation of wages to the farm income and the value of wages from the laborer's point of view. Section 3 comprises tabulated data.

Accident insurance law for agricultural workers in France (*U. S. Dept. Labor, Bur. Labor Statis., Mo. Labor Rev., 16 (1923), No. 3, pp. 136–139*).—The provisions of the law of December 15, 1922, extending to include agricultural workers the French accident insurance law of April 9, 1898, are given.

Agriculture and the International Labor Organization (*Internatl. Labor Off. [Geneva], Internatl. Labor Rev., 7 (1923), No. 4, pp. 642–648*).—This is a brief review of efforts to organize the agricultural worker.

Weather, Crops, and Markets (*U. S. Dept. Agr., Weather, Crops, and Markets, 4 (1923), Nos. 1, pp. 24, figs. 5; 2, pp. 25–56, figs. 4; 3, pp. 57–88, figs. 3; 4, pp. 89–112, figs. 3*).—Temperature and precipitation charts for the weeks ended July 3, 10, 17, and 24, 1923, are presented in these numbers, with general and weekly summaries of weather conditions. The usual weekly and monthly reports, tabulated summaries, and special articles relating to the receipts and prices of important classes of crops and livestock and the current position in the market of specific commodities are given. Crop reports in No. 1 include a survey of cotton condition and forecasts for June 25, with comparisons; a study of corn and hog ratios, 1910 to 1922; a brief review of the average apple crops, 1898 to 1922; and the results of the pig survey, June 1, 1923. No. 2 presents general summaries of crop prospects and conditions on July 1, the usual farm value tables, and miscellaneous special crop reports. In No. 3 appear a forecast of the production of five truck crops and other brief notes. The report of a committee of economists and statisticians called by the Secretary of Agriculture to consider the foreign and domestic demand for farm products and particularly the wheat, corn, and hog situation is published in No. 4. The principal reports given in this number relate to broomcorn, pasture and stock condition, and honey production.

Preliminary report of the Federal Trade Commission on the cotton trade (*Washington: Govt., 1923, pp. XI+28*).—This is made pursuant to a resolution of the Senate of the United States directing the Federal Trade Commission to inquire into "the cause, or causes, of the present depressed price of cotton in the United States." It summarizes the chief reasons for both the high prices of cotton in 1919–20 and the low prices between 1920 and 1922. Consideration is given to production, stocks, consumption, imports, and exports. The available information regarding the quantities of linters untenderable and unspinnable cotton, contracts sold on the exchanges, and deliveries made on such contracts is given.

Chicago wheat prices for 81 years, J. E. Boyle ([*Ithaca, N. Y.: Author*], *1922, pp. 16, pls. 17, figs. 2*).—In these pages the author reviews the daily, monthly, and yearly fluctuations in wheat prices in Chicago through the period from 1841 to 1921. Between 1841 and 1860 there was no future trading of an organized nature. In the Civil War period, or between 1861 and 1870, it had a rapid rise, and from 1871 to 1921 future trading was conducted on the organized grain exchange under definite published rules. It is intended to trace here the stabilizing effect of future trading on prices. The numerous graphs are based upon statistics taken from Chicago newspapers of the period.

An economic résumé, 1923, G. Mortara (*Prospettive Economiche, 1923. Milan: Univ. Com. Luigi Bocconi, 1923, pp. XIX+425*).—This yearbook gives an account of the economic and commercial prospects of Italy in chapters on grain, wine, olive oil, fruit and vegetables, silk, cotton, fibers, linen, and other products, as well as on transportation, public finance, money, emigration, and labor.

Report on economic conditions in Russia, with special reference to the famine of 1921–22 and the state of agriculture ([*Geneva*]: *League of Nations, [1922], pp. VIII+164, pls. 3*).—This is a compilation from published

information with reference to conditions in Russia, including Russian official publications and those of other Governments, relief agencies, and other private organizations.

In a Russian village, C. R. BUXTON (*London: Labour Pub. Co., Ltd., 1922, pp. VIII+9–96*).—This is a narrative account of the author's stay in an agricultural village and of other travels in Russia.

[The principal agricultural resources of Manchuria] (In *Manchuria: Land of Opportunities. New York: South Manchuria Railway, 1922, pp. 13–27, pls. 4, fig. 1*).—Notes on important crops and livestock are given.

Rural planning—the social aspects, W. C. NASON (*U. S. Dept. Agr., Farmers' Bul. 1325 (1923), pp. II+30, figs. 25*).—Specific examples are described, from the social viewpoint, of rural planning of recreation places, public grounds and school building sites, roadside planting, and trade and civic centers in the United States.

Village life and country industries (*Jour. Min. Agr. [Gt. Brit.], 30 (1923), No. 3, pp. 215–223*).—This article, which is concerned with general aspects of the problem of rural industries, introduces a series which will deal in detail and from a practical standpoint with specific industries which already exist or may be revived or established in country districts of England.

AGRICULTURAL EDUCATION.

Analytic survey of State courses of study for rural elementary schools, C. M. REINOEHL (*U. S. Bur. Ed. Bul. 42 (1922), pp. V+116, figs. 2*).—This investigation undertakes to analyze and interpret the character and content of State courses of study for rural elementary schools, presenting in tabulated form the aims, subject matter, and materials most frequently recommended in the courses for all but the four States of California, Florida, Arkansas, and Rhode Island. All but 8 of the 44 courses used had been issued since 1914. By January 1, 1920, 21 had been revised or reprinted, but of these only 40 per cent show marked changes as to point of view, content, organization, or adaptation to rural schools. A few States now provide courses for use in rural schools exclusively.

An average of 214 pages each was contained in these courses, and of this number 20 pages were devoted to general suggestions consisting of things outside of discussions or outlines of subjects. The most frequently mentioned general topics were daily programs and libraries, while among those less frequently given were the aims of the school, the plan of the course, and its intelligent use. A majority of these courses give teachers little constructive help as to the best teaching methods. Among other topics of a general nature which the author deems deserving of treatment are standardization of schools, useful supplies and materials, and community activities of an educational nature.

The range of daily recitation periods on 26 model programs for one-teacher schools taken from as many State courses is from 21 to 38, with 85 per cent of the programs limiting the number to 25, depending partly on the number of grades and of subjects involved. The economy in the number of daily recitations is made possible by the plan of alternation and combination of grades and classes recommended by 73 per cent of the courses surveyed. The grades usually combined are the third and fourth, the fifth and sixth, and the seventh and eighth. The programs assigned 60 per cent of the teacher's time to arithmetic, reading, and language. A balanced program of 24 daily courses for one-teacher schools, designed to do justice to all children and to all subjects, is submitted by the author with the aim of increasing the amount of the teacher's time devoted to children in the lower grades. Certain principles for the organization of courses and schools are formulated.

A chapter is devoted to a study of the relative importance of subjects. It is brought out that outlines for every grade in every one of the 17 elementary school subjects contained in the State courses are provided in one or more courses, and it is held that this number needs to be materially lessened. The number of pages for the outlines in each subject and for each grade is computed. The total space assignments to each grade and to each subject are strikingly uneven, ranging from one page in several grades in each of two subjects to 259 pages in eighth-grade agriculture. The amount of space allotted to ungraded materials or general suggestions in each subject is very large. The courses for each grade vary in length, from paragraph discussions to outlines of many pages. Subjects with more of content and less of form hold a prominent place in the curriculum, and subjects receiving little or no class instruction are allotted less space than others.

A chapter is given to a quantitative treatment of content materials, giving the number of topics contained in the State courses of study distributed by subjects. The extent of correlation recommended is also given. Of the 3,504 topics, including the subject matter and methods topics and those referring to aims in teaching, 1,192 were found to occur in 40 per cent or more of the 35 selected courses or fewer courses in any one subject. Eighty-five per cent of the listed topics appear in the list of one subject only, 10 per cent in the lists of two subjects, and 5 per cent in the lists of more than two subjects. There is a need for the discontinuance of topics not answering to the needs of farm children and for the reselection and proper evaluation of materials in the light of social and economic progress. The subjects of English, arithmetic, citizenship, elementary science, and industry and art are taken as coordinating centers for organizing content materials for economy of time, and five chapters are devoted to analytic surveys of these five subjects as correlating mediums.

State courses were found to contain the titles of 4,172 books and bulletins. This large number makes necessary selection on the part of the teachers.

An extensive reference list, including books and bulletins on rural schools and courses of study, is given.

Junior high schools in rural sections, I. E. WHITTICO (*South. Workman. 52 (1923), No. 5, pp. 239–241*).—Certain particular advantages of junior high schools in meeting the problems of negro education in rural districts are pointed out.

Home economics education, H. W. CALVIN (*U. S. Bur. Ed. Bul. 6 (1923), pp. 19*).—A report on the progress in home economics teaching in elementary schools, high schools, and higher institutions, research, and social service work, together with various phases of activity on the part of State institutions, the Merrill-Palmer School, Johns Hopkins University, the U. S. Department of Agriculture, the Federal Board for Vocational Education, the Bureau of Education, and the American Home Economics Association, is printed here as advance sheets from the Biennial Survey of Education in the United States, 1920–1922.

A marked stimulation of local interest in home economics in elementary schools is noted. The type of high-school instruction in foods has been sharply modified, and cooking processes receive less stress than formerly, nutrition and dietetics receiving greater emphasis. Greater stress is being placed upon the economics of clothing than upon the technique of garment making. Budgeting personal and household incomes is emphasized in all high-school courses.

In the matter of assignment of rooms for home economics uses it is held that either the first or the top floor will prove satisfactory if properly equipped. The accepted plan for the arrangement of cooking equipment provides for one cabinet gas stove where gas is available, and one small sink and table space,

approximately 5 by 4 ft., for each group of four girls. There is said to be no unanimity of opinion concerning the so-called unit kitchen.

The extent to which women trained in home economics are sought for commercial and technical positions is pointed out.

Agricultural instruction in Cuba, C. B. HURST (*Bul. Pan Amer. Union, 57 (1923), No. 1, pp. 52–56, figs. 3*).—Agriculture has been included in the curriculum of the rural schools of Cuba since 1914, and each rural school is required to provide a field for agricultural experiments which the school children shall cultivate themselves under the direction of their teachers.

Upon the reorganization of the rural schools in 1921, improvement was made in elementary courses in agriculture, and it was endeavored to give practical demonstration of modern methods of cultivation. Provision was made also for the training of teachers. A teacher training course has been inaugurated at the Quinta de los Molinos in Havana, and an opportunity is offered there for actually cultivating a small experimental plat.

MISCELLANEOUS.

Report of the director for 1922, E. H. JENKINS (*Connecticut State Sta. Bul. 243 (1922), pp. 167–180*).—The work of the station during the year ended October 31, 1922, is briefly summarized by departments.

Annual Report of Nevada Station, 1922, S. B. DOTEN (*Nevada Sta. Rpt. 1922, pp. 20, figs. 2*).—This contains the organization list, a financial statement for the fiscal year ended June 30, 1922, and a report of the director discussing the work and problems of the station during the year.

Science serves Wisconsin farms: Annual report of the director for 1921–22, H. L. RUSSELL and F. B. MORRISON (*Wisconsin Sta. Bul. 352 (1923), pp. 122, figs. 57*).—This contains an account of the activities of the station, a list of the station publications of the year, and a financial statement as to the Federal funds for the fiscal year ended June 30, 1922. The experimental features not previously reported are for the most part abstracted elsewhere in this issue.

The work of the Newlands Reclamation Project Experiment Farm in 1920 and 1921, F. B. HEADLEY and E. W. KNIGHT (*U. S. Dept. Agr., Dept. Circ. 267 (1923), pp. 26, figs. 9*).—The agricultural conditions on the project are described, meteorological data summarized, and the experimental work of the two years reported, as abstracted elsewhere in this issue.

Monthly Bulletin of the Ohio Experiment Station (*Ohio Sta. Mo. Bul., 8 (1923), No. 5–6, pp. 65–96, figs. 6*).—This number contains, in addition to several articles abstracted elsewhere in this issue and miscellaneous notes, an article entitled Why a Good Steer Did Not Thrive, in which injury to the stomach and diaphragm from baled hay wire is reported.

NOTES.

Alabama College and Station.—D. T. Gray, dean of the College of Agriculture and director of the station, has accepted a corresponding position in the Arkansas University and Station.

Arizona University and Station.—The station has been granted a definite fund in lieu of its receipts from the sales of products.

The practice of distributing publications to a regular mailing list has been discontinued by the station. Return postal cards are now sent to all persons on the mailing list, and requests are filled from the replies received.

Harry Embleton, extension poultry husbandman at the Colorado College, has been appointed assistant professor of poultry husbandry and poultry husbandman.

Illinois University and Station.—The new agricultural building has been completed and will be occupied in part by the administrative offices and portions of the horticultural and extension departments. The old agricultural building will be used largely for the departments of agronomy and dairy husbandry. Construction is under way on the new dairy barns.

Recent appointments include E. T. Robbins as assistant professor of animal husbandry extension and Harold F. Jenkins as research assistant in olericulture.

Purdue University.—The university has purchased a farm of 422 acres north of the station, primarily for use in livestock experiments which have hitherto been carried on with leased land. The farm is well drained, equipped with buildings, and is to be used for extensive experiments with cattle, hogs, and sheep.

Plans have been approved for a new poultry building of two stories with finished attic and basement. Its dimensions will be 117 by 41 ft., with a judging pavilion 52 by 60 ft. in the rear.

Iowa College and Station.—A library building of Bedford stone to cost $500,000 is under construction. A judging pavilion has been completed at the dairy farm at a cost of $10,000.

Additional land aggregating 152 acres south of the college has been purchased for the use of the departments of horticulture and animal husbandry.

W. A. Foster, assistant chief of the department of agricultural engineering, has resigned to become head of the department of agricultural engineering in the University of Georgia. P. H. Elwood, professor of horticulture in the Ohio State University, has been appointed professor of landscape architecture. Other appointments include J. F. Thaden as research assistant in rural sociology, Burton Morgan as instructor in vocational education, J. C. Holbert and W. E. Beanblossom as instructors in animal husbandry, J. C. Schilletter as instructor in horticulture vice T. R. Hall, Dr. H. J. Harper as associate professor of soils and assistant chief in soil chemistry, and Dr. L. W. Erdman of the National Research Council as assistant professor of soils and assistant chief in soil bacteriology.

Kansas College and Station.—Dr. Earl B. Working has been appointed associate professor of the milling industry vice P. L. Mann, resigned. Dr. Don C. Warren has been appointed associate professor of poultry husbandry

and in charge of poultry breeding work at the station. Arthur D. Weber has been appointed instructor in animal husbandry and assistant animal husbandman vice W. R. Horlacher, resigned, and R. H. Lush instructor in dairy husbandry vice R. B. Becker, resigned. Other new appointments include V. R. Hillman as assistant professor of agricultural engineering, Dr. William R. Hinshaw as instructor in bacteriology, and J. A. Hodges as instructor in agricultural economics.

Rutgers College and New Jersey Stations.—Darrell B. Lucas has been appointed assistant in rural engineering, September 1. Carl R. Woodward, editor, has been granted leave of absence for the present college year to be spent in graduate work at Cornell University.

Cornell University and Station.—W. A. Stocking has resigned from administrative duties as head of the dairy department and has been succeeded in this capacity by J. M. Sherman of the Dairy Division, U. S. Department of Agriculture. Charles H. Merchant, instructor in marketing, has been appointed assistant professor of agricultural economics in the Utah College.

Ohio State University.—The university purchased July 1 a farm of 155.5 acres adjoining the present farm and making a combined tract of 702.5 acres, in addition to 124 acres which are being rented. The new farm will be used largely for the production of feed for the university live stock, thereby decreasing operating expenses. A rotation of two years of corn and four years of alfalfa is to be used, which it is expected will materially build up the soil fertility.

E. L. Dakan, poultry specialist in the extension department, has been appointed head of the poultry department.

Porto Rico Federal Station.—W. V. Tower, entomologist, has resigned to accept a commercial position with a Porto Rican tobacco company.

Twelfth Convention of International Association of Dairy and Milk Inspectors.—The twelfth annual convention of this association was held at Washington, D. C., on September 28 and 29 and October 1, with an attendance representing city, State, and Federal health departments, the U. S. Department of Agriculture, the dairy industry, and other interests.

The address of welcome at the opening session was given by W. C. Fowler, health officer of the District of Columbia. The presidential address of G. E. Bolling summarized the history of milk inspection and the formation of the association.

The report from the committee on dairy methods dealt with methods of cooling and was divided into four parts. The first part, by E. Kelly, took up Milk Cooling Regulations from the Standpoint of Control Agencies. On the basis of replies to a questionnaire from 15 cities distributed over the United States, he recommended better enforcement of the existing regulations in cities, with a gradual stiffening of the requirements as dairymen become better educated to the necessity of producing a cleaner milk supply. Cooling of Milk from the Standpoint of the Producers and the Receiving Station was reported on by H. A. Harding, who reviewed experimental work showing the rate of bacterial growth in milk at different temperatures and emphasized the necessity of the proper cooling of milk delivered at receiving stations more than 2½ hours after milking. The third part of this report was given by W. D. Dotterrer, who discussed Milk Temperatures and Bacterial Content of Milk at Time of Delivery, stating that the results of bacterial counts made by the Breed direct microscopic method on 890 samples of night's milk indicated that where the temperature is kept under 60° F. the bacterial count is not likely to double over night when compared with the bacterial count of morning's milk. G. C. Supplee, chairman of the committee, summarized its work as a whole, stating that

the initial responsibility for the quality of the milk rests with the producer, and that temperature regulations are justifiable as a means of assisting in controlling the quality, though temperature is not always an exact indication of quality.

The report of the committee on bovine diseases, their relation to the milk supply and the public health, was given by J. B. Hollingsworth, who suggested a regular application of the tuberculin test and the elimination of tubercular cattle as a means of improving human health and reducing infant mortality. E. R. Gauhn discussed the subject of The Influence of the Area Plan of Tuberculin Testing.

Among the results of milk inspection in New Haven, C. H. Amerman stated that by proper education consumers there have come to demand lower bacterial counts in the milk and more care in milk production. I. V. Hiscock spoke of the methods to be used in educating the public as to the value and care of milk, mentioning the use of newspapers and school children especially, but also considering of value pamphlets, circular letters, radio, posters, essay contests, and addresses to various clubs. J. W. Yates described the measures practiced in Kansas City for safeguarding the milk supply. All dairy herds and milk handlers receive physical examinations monthly, and the cattle are tested for tuberculosis annually or semiannually.

In the report of the committee on the transportation of milk and milk products, a number of suggestions were offered by R. S. Smith for bringing about better cooperation between producers, railroads, and distributors. C. E. Clement, reporting for the committee on milk plants, described the ideal type of plant as consisting of 1 or 1½ stories, with the pasteurizer located on the mezzanine floor and all equipment efficiently arranged and easily cleaned. H. E. Van Norman spoke briefly on the factors contributing to the progress of dairying in the United States and made an appeal for uniformity of equipment and simplification of regulations. I. F. Rosinek of Czechoslovakia described conditions surrounding the dairy industry in that country.

F. D. Walmsley of Chicago described the practical application of a premium system to the production of quality in a milk supply. The work was first started by educating the farmers to the methods of improvement by regular visits at milking time. Increased prices were later paid for low count milk.

The report of the committee on pasteurization of milk and cream was presented by W. H. Price, who defined pasteurization as the heating of milk to a temperature of approximately 145°, never lower than 142°, holding every particle of the milk at that temperature for a period of at least 30 minutes, and then promptly cooling below 50°. He further stated that as yet no adequate substitute for pasteurization has been developed. At a subsequent session, the findings of this report were put in the form of resolutions and adopted by the association as expressing its belief in proper pasteurization, not as a cure for dirty and unsanitary methods but as a safeguard to health.

The report of the committee on food value of milk and milk products was prepared in two parts by O. M. Camburn and R. J. Possen, respectively. The first part emphasized the food value of milk and its products, and the second part referred to the benefits to children, as determined by the specialists of the Dairy Division, which have been brought about by supplying milk in the schools and at home. T. J. Strauch described the plan of Richmond's standard dairy barn to which the barns of all farms supplying milk to that city now conform, and C. O. Seaman spoke on What the Dairy and Milk Inspector Can Accomplish for His Community.

The report of the committee on remade milk, given by C. S. Leete, consisted of the results of a study of the physico-chemical properties of remade and

raw milk. W. P. B. Lockwood presented the report of the committee on serving milk in schools, in which he stated that there seems to be a necessity for educating the people in correct food and living habits and that milk is among the remedies. The best type of milk legislation was described by L. C. Frank, the more important points to be included in municipal milk ordinances being clearly discussed. B. Vener made an appeal for more care in methods of sampling ice cream for bacterial and chemical analysis.

G. E. Bolling, chairman of the committee on methods of bacterial analysis of milk and milk products, reported for that committee that work was being continued along the lines of a study of different media. W. D. Dotterrer discussed irregularities in bacterial counts of pasteurized milk, stating that the milk of some plants seemed to contain flora which were very resistant to pasteurization. At three farms this was found to occur when poorly cleaned milking machines had been used. A comprehensive system of dairy inspection for all dairy products was outlined by J. J. Frey. Miss S. H. Vance showed by means of charts the improvement in the milk supply which had been brought about in certain small towns in Kentucky through the employment of a milk inspector.

C. L. Roadhouse, of the University of California, showed the relation between the acidity and butterfat content of milk and cream. H. A. Harding discussed the relative influence of different steps in milk production on the bacterial count of the milk, enumerating as the most likely causes of high counts dirty cows, milking machines, and cans and improper methods of cooling. J. W. Yates described certain pinpoint colonies which have been observed in pasteurized milk. These bacteria increase rapidly in the milk in pasteurization temperature and grow better on bacto agar than on pre-war media. L. C. Bulmer reported that the bacterial content of milk in Birmingham, Ala., had been materially reduced by milk inspection.

T. Clark discussed dried milk for infant feeding and presented the results of an experiment in Boston where infants receiving milk reconstructed from whole milk powder gained more rapidly than other groups of infants receiving pasteurized milk or milk reconstructed from butter and skim milk powder. R. S. Smith discussed the relative efficiency of different methods of washing milk bottles, and K. L. Ford described the manufacture of glass milk bottles. W. S. Frisbie suggested the adoption of more uniform methods of dairy and milk inspection by the officials of the different States. The report of the committee on communicable diseases affecting man (relation to the milk supply and to the public health), presented by the chairman, G. K. Cooke, consisted largely of evidence in favor of pasteurization as a protection to human health.

At the final meeting, E. C. Schroeder spoke of the properties of butter which make it an ideal media for carrying bacteria originally present in the milk. He, therefore, recommended the pasteurization of cream to be used for butter making and the labeling of butter so made. J. A. Kiernan reviewed the progress of tuberculosis eradication work in the United States and told how the area plan is rapidly growing and eradication is becoming more popular. The last speaker, T. P. Sze, vice consul of the Republic of China, gave a description of dairying in China, where milk is coming into more general use, although it is yet very expensive.

Officers for the ensuing year were elected as follows: President, J. B. Hollingsworth, Ottawa, Canada; and vice-presidents, T. J. Strauch, Richmond, Va., G. C. Supplee, Adams, N. Y., and C. H. Chilson, Detroit, Mich. The secretary-treasurer, I. C. Weld, Washington, D. C., was reelected.

EXPERIMENT STATION RECORD.

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A period of four years has now elapsed since the metamorphosis of the Association of American Agricultural Colleges and Experiment Stations into the Association of Land-Grant Colleges. The close of the thirty-seventh convention of the organization, held like its forerunner of 1919 in Chicago, finds continued adherence to the main principle embodied in the new plan but with modifications in several more or less important particulars. Even now, some of the details of organization are apparently still in process of evolution.

Legislative functions remain in the hands of the executive body, originally composed of the presidents of the constituent institutions, but the composition of this group has been materially altered. Under a constitutional amendment adopted in 1922, the presidents are now empowered to appoint substitutes. This privilege has been extensively resorted to, and only about a score of the colleges and universities were represented by their chief executives at Chicago. Evidently the advantages prophesied of increasing the attendance of the presidents and adding to their intimate knowledge of association matters have not been fully realized.

The personnel of the executive body has been further broadened by amendments including ex officio the officers of the association and the members of the executive committee. This change has evidently favored a closer grasp of the matters in hand.

The policy of excluding the general public from all sessions of the executive body has been adhered to, and seems to have become quite firmly established. It has, of course, one practical disadvantage in that the majority of those in attendance at the conventions are obliged to leave at the close without authoritative information as to the disposition by the executive body of the various matters referred to it for decision. This diminishes interest in the proceedings, but presumably the advantages of the policy are deemed sufficient to outweigh the disadvantages.

The precise scope of the association formed a subject of discussion in the executive body in the sessions just completed, particularly with reference to a tendency ascribed to certain sections to deal in their programs with subject matter problems rather than with administrative matters. It was pointed out that deans, directors, and

home economics heads are delegated to attend the meetings in their administrative capacities and not as subject matter specialists. In order that future programs should reflect quite accurately the administrative functions of the association, the executive body adopted a suggestion from the executive committee that hereafter immediately following each convention the secretary should advise each member of section program committees of this viewpoint.

Two additional constitutional amendments were adopted at Chicago. One of these lengthened the terms of membership of the executive committee from one year to five years, the term of one member only expiring each year. A provision in the amendment as submitted in 1922 making ineligible for immediate reelection the member whose term had expired was eliminated from the clause as adopted. It is thought that the new arrangement will insure continuity of policy in the executive committee.

Under the second amendment, the president of the association is made ex officio a member of the executive committee and is empowered to fill vacancies on standing committees as they occur, as well as to appoint all special committees not otherwise provided for by the executive committee. The previous constitutional provision for the filling of vacancies had been by election by the remaining members of the committees themselves, and this system had proved unwieldy.

The Chicago convention was attended by well over two hundred and fifty persons. The registration showed representatives from every State, and in many instances of complete delegations for the subdivisions of agricultural instruction, research, and extension, home economics, and engineering. Of the station directors, forty-one were in attendance, the only States not represented in this group being Arizona, Maryland, Massachusetts, Montana, Oregon, Virginia, and Washington.

The program of the convention, scheduled from November 13 to 15, was in general conformity with those of recent years, with three general sessions, two meetings of the executive body and an informal conference of presidents, and two-day programs of the sections of agriculture and engineering. The section on agriculture held parallel half-day sessions of its divisions of resident teaching, experiment stations, and extension, and three joint sessions dealing with questions pertaining to the interests of each of the divisions in turn.

The first two general sessions were transferred from evening to afternoon, special care being taken to insure against overlapping by any of the sections. The evenings were given over to informal dinners of the station directors, college and university presidents, extension directors, and home economics and engineering heads and to sectional programs. There was considerable variation in the sessions as to fullness of program, some groups finding ample oppor-

tunity for discussion and others a good deal of congestion. The section on home economics secured an additional half day by meeting on the afternoon preceding the other groups, and the extension division interpolated an emergency session.

The number of organizations meeting at substantially the same time as the association was larger than for several years. In the field of subject matter there were the American Society of Agronomy, the American Association of Soil Survey Workers, and the American Association for the Advancement of Agricultural Teaching. A special meeting of the Association of Southern Agricultural Workers considered a report of its committee on cotton production and boll weevil control. The Association of State Universities held its usual executive sessions, and a new organization, the Association of State University Regents, was formed with a representation of about fifteen institutions.

The convention program bore many evidences of careful planning, and interest was well sustained. In response to a feeling that there was need of special emphasis on the responsibilities of the land-grant institutions along cultural lines, unusual opportunity was given in the general sessions for the presentation of this phase of undergraduate education.

The presidential address, given by President Howard Edwards of Rhode Island, was a scholarly discourse bearing the comprehensive title of Matter, Man, and the Morning Star. The first of these categories he described as pertaining to the material universe and its physical relations. The second embraced man himself and his modes of intellectual and emotional expression through language, literature, history, painting, and music. Beyond these, however, he conceived a third category, "climbing slowly, hesitatingly, painfully up out of the black abyss of the unconscious out into the starlight of consciousness and intelligence, out on the tableland of intuition and emotion where shines most brilliantly the morning star of faith in human destiny, pledge and presage of the dawn, hope and promise of a finer life and a nobler race."

While it is impossible and dangerous to attempt to draw exclusive demarcations between these interpenetrating areas of thought and study, undue emphasis upon some one of them may be somewhat readily accomplished by the different classes of educational institutions. President Edwards expressed the belief that the great weakness and danger of the land-grant college is commercialized materialism. "It is a part of our fundamental charter," he said, "to give higher instruction for the world's business, for the industrial pursuits and professions of life. . . . It is a lofty function worthy of the finest mind and compatible with the highest ideals. It is the motivation

that must be sedulously guarded. It must be a 'liberal and larger education' that is imparted. It must not degenerate into an equipment for mere personal gain." To prevent this there must be an "integration of all our teaching through the right motivation of our students."

This stimulating philosophical discussion was supplemented in several other papers and addresses. One of these was by Dr. A. Ross Hill of Missouri on the subject of the Contribution of Land-Grant Colleges to Liberal Culture, and another by Dean D. S. Kimball of Cornell University on the Content of a Liberal Education. Defining liberal culture as "to be possessed of insight into and appreciation of modern civilization and responsive to its claims," Dr. Hill found no justification for the view that the pursuit of any study, especially modern science, with a vocational motive robs the process of cultural value. On the other hand, such subjects as rural economics and rural sociology he considered admirable supplements for technical courses in agriculture. The ideal of service he found to have been stimulated and given practical enforcement by the land-grant colleges, and he termed our professors of agriculture "educational missionaries from the outset." Dean Kimball likewise, in an address which deserves wide reading, expressed the view that every professional course can be so given as to be liberalizing, and that more depends upon the personality of the teacher than on the subject matter. He too pointed out that the land-grant colleges are committed traditionally to liberal mindedness.

The improvement of the quality of college teaching has been a matter of much discussion in the association in recent years. Two papers were given on this subject by Prof. F. M. McMurry of Teachers' College, Columbia University, one before a general session on Fundamental or Guiding Principles of Classroom Instruction and the other before the division of resident teaching on The Opportunity of Administrators to Influence Class Instruction. In these papers Professor McMurry brought out very clearly that real classroom teaching is much more than the imparting of knowledge, being rather the leadership of the thinking process of the student. Greater supervision of college teaching was advocated as tending to growth on the part of the teacher and adoption of better pedagogical methods.

Still another phase of the matter was brought forward in the report of the committee on instruction in agriculture, home economics, and engineering, in which the question of better means of adapting instruction to the relative abilities of students was put forward. A growing feeling that the exceptional student is unduly handicapped by his mediocre or indifferent confrere was noted, and the suggestion made that the plan of division of classes on the basis of ability, determined in part by psychological tests, should be given thoughtful consideration.

A noteworthy feature of the convention was the attendance and participation of two members of the Cabinet. One of these, Hon. Hubert Work, Secretary of the Interior, took for the subject of his address The Farm Home. In this he advocated the development of agencies tending to lighten the burden of the women in the country home, from which "must come the men who will do the thinking for this great Nation."

The address of Secretary Wallace of the Department of Agriculture dealt largely with the general condition of agriculture and the relations of the Department and the agricultural colleges. He dwelt upon the community of purpose of these institutions, and especially their opportunities and responsibilities along economic lines. In his opinion, more attention must be given to the determination of the proper acreage for specific crops, the improvement of marketing methods, cooperative work in general, and the ascertaining of world conditions. The colleges must be looked to for trained men to take up these problems, and he pointed out that the duty of Department and college alike is not alone to teach individuals but to promote a sound agriculture which will include living conditions. He alluded to the recent completion by the Department of its organization under directors of scientific, regulatory, and extension work, and expressed the belief that closer relations with the colleges should thereby be made possible.

That the colleges are realizing their responsibilities along economic lines was indicated by the fact that two of the three joint sessions of the section of agriculture dealt largely with economic matters. The joint session devoted to resident teaching was addressed by two of the pioneer workers in agricultural economics, Drs. B. H. Hibbard of Wisconsin and H. C. Taylor of the Bureau of Agricultural Economics. In the session for extension work, the factors to be considered in the development of a State program of agricultural improvement were discussed from the standpoint of economics by Director F. W. Peck of Minnesota and from that of sociology by Prof. C. E. Lively of Ohio.

In all of these papers, the need was clearly recognized of relating economic facts and doctrines very definitely to the agricultural problems of the present time and of seeking to provide adequate remedies. As Dr. Taylor expressed it, "that type of economic discussion which shows that the present distressed financial condition of our farmers is due to certain well-defined economic forces but which prescribes no remedy will not find a permanent place in our agricultural colleges. If economic teaching can do no more than to assure farmers of the virtue of patience while waiting for economic forces to run their course, this subject should give way to more important branches in the curriculum." He went on to point out

that "economic investigations should form the foundations of programs for State and Federal economic legislation affecting farmers. . . . The one way to eliminate radical economic programs and radical leadership and to improve the quality of the agricultural statesmanship of this country is for the economist to take an active and leading part in developing sane programs of action which will get results."

Another in the long series of useful bibliographical reports was presented by Dr. A. C. True. This report took the form of a selected list of about seventy-five references to publications on scientific and technical writing, and indicated that a surprisingly large amount of assistance is now available to the prospective writer of scientific articles.

A pleasant feature of the convention program immediately following this report was the delivery by President Edwards of a graceful tribute of appreciation for the thirty-five years' service of Dr. True as educator and administrator. This tribute emphasized Dr. True's directive work in the years of development of agricultural research and education under the Hatch Act of 1887, the Adams Act of 1906, and the Smith Lever Act of 1914, stating that "in wise statesmanship, constructive effort, working smoothly without noisy declamation and with quiet effectiveness, he has not been surpassed among us." At a session of the extension workers, this group likewise expressed its appreciation of Dr. True's services by word and gift.

The widening scope of the association's interests was reflected in its contacts with other organizations. The American Farm Bureau Federation was again represented on its program, this time by its new president, Mr. O. E. Bradfute, who gave an address on the relations of agricultural organizations to agricultural colleges. This was followed by a corresponding address by President Pearson of Iowa on the relations of agricultural colleges to agricultural organizations. Representation was continued by the association in the National Research Council and the American Council of Education, and addresses were made in behalf of the American University Union and the International Institute of Agriculture. Action was also taken by the executive body in response to overtures from the Association of Institutions for the Colored Race, authorizing its executive committee to confer with representatives of that body to discuss the question of greater cooperation.

The interests of research were perhaps less conspicuously in the foreground than at some other recent conventions of the association, yet there was no dearth of sympathetic consideration. A noteworthy feature of the final session was an address by Hon. F. S.

Purnell of Indiana on the bill sponsored by him in Congress to provide additional Federal funds for the work of the agricultural experiment stations, and this proposed legislation was the subject of discussion at several other meetings.

The fundamental position of research in an agricultural program was referred to by several speakers. Among these was Dr. Eugene Davenport, dean and director emeritus of Illinois, who declared that its continued support and development was of the utmost urgency as the most hopeful of the many remedies being put forward to rectify the ills of the agricultural situation.

In a paper entitled The Administration of Agricultural Research, Dr. E. W. Allen of the Office of Experiment Stations discussed this important question with reference to the standpoint of the experiment stations. He showed that the need for administration in research in these institutions rests on three main things. The first of these is the nature of the station itself as a public agency of organized character. The second is the nature of individuals, the differences in their preparation, and the readiness with which they accept the idea and underlying purpose of an experiment station. Finally, there is the nature of the program, the particular things the station selects to do, and the orderly prosecution of that program. Because of all these factors there is need of a directing hand. Judicious administration, it was pointed out, supplements the efficiency of the component parts of the organization, helping to create a favorable atmosphere and stimulating individuals to a broader outlook. "Administration can not put into a man what is not in him, but it can stimulate his development if the basis is there, and it may help him to make better preparation and to elevate his standards."

An increasing readiness to think of research problems as matters seldom delimited by State boundaries has been an encouraging development of recent years. Of late, the regional concept has been much in evidence. At Chicago, the question of regional conventions and regional cooperation in projects of experiment station workers was taken up by Directors D. T. Gray of Alabama and J. G. Lipman of New Jersey. Director Gray recounted some of the accomplishments of the Association of Southern Agricultural Workers in this field, notably in the promotion of systematic tick eradication, uniform fertilizer legislation, the formation of a Council of Livestock Research Workers, the prosecution of cooperative soft pork investigations, and studies of the effect of locality on the length of the cotton staple. He claimed for regional studies an enlargement in the scope of the attack and a reduced ultimate expenditure, the development of a greater spirit of confidence in the work on the part of the general public, the relieving of a State of the necessity

of attacking all problems independently, the standardizing of methods of experimentation, greater tendency to keep in sight the ultimate practical application of the study, and the greater permanency and stability enjoyed by regional studies.

Dr. Lipman attributed distinct advantages to regional conferences, such as the readier differentiation of the local from the more general factors in interpreting results, the development of a more clearly defined plan of attack, the more adequate interpretation of negative findings, and the promotion of valuable professional acquaintance. Cooperation in the actual solution of regional projects he regarded as less simple because of the human factor involved, although where practicable he found it to possess many of the merits enumerated for conferences and to be especially serviceable in the training of the younger men by giving them a wider outlook and enthusiasm.

A concrete indication that the benefits of regional gatherings are being increasingly recognized was afforded by the partial reorganization at Chicago of the American Society of Agronomy on a sectional basis. Under the new plan, the executive committee of this society will consist of the president and a representative from the North Atlantic, Southern, Corn Belt, and Western sections. Already the Corn Belt section has held regional gatherings, and it seems reasonable to suppose that they will become more and more frequent as the soundness of the principle of common interests on which they are based is demonstrated.

The program in the experiment station division at its separate session dealt with two main questions, the proper development of an informational service and station problems in the utilization of uncultivated lands. Discussion of the former topic was opened by Prof. A. W. Hopkins of Wisconsin, who presented a study of recent trends in the form of publications and their channels of distribution. He reported a decrease in all regular station mailing lists from 1916 to 1921 from 1,147,309 to 899,079 and in the total number of station publications per annum from 1,733 to 830, the latter due in considerable measure to publication of technical matters in scientific journals. A condensation in the bulky annual reports and the substitution of a more popular method of presentation of the station work was noted, likewise the abandoning of mailing lists in some States and their modified use in others. Considerable variation in the expenditures for publications was reported, one State expending 1.2 per cent of its station funds for this purpose and another 4.7 per cent. For station and extension publications combined, the expenditures per farm ranged from 0.5 cts. to 42 cts., with an average per State of 2 cts.

A paper submitted by Director F. B. Linfield of Montana described some of the problems encountered nowadays in distributing

the various forms of publications to the best advantage. The ensuing discussion brought out quite clearly some of the difficulties which confront many institutions because of limited editions and variable demands. Bulk requests, often from other States, have come to be a frequent source of embarrassment, and various expedients were mentioned to conserve the funds available. It appears that various aspects of this problem will press for solution more and more urgently as time goes on.

The importance of an economic utilization of the vast areas of uncultivated lands was brought out in papers by Director S. B. Doten of Nevada and Vice Director C. A. Willson of Tennessee, largely on the basis of conditions prevailing in their respective localities. The outstanding problem in this field in Nevada is that of the restoration of depleted sheep and cattle ranges, while for the Eastern States particular stress was laid on the need of extensive experiments relative to the better utilization of cut-over forest lands, swamp lands, and abandoned farm areas. The desirability of a definite national policy was brought out in the discussion which followed, and a special committee was appointed to take up with the executive committee the matters which had been presented with a view to centering attention upon them in the 1924 convention. As a result of this action, Dean H. L. Russell of Wisconsin was invited by the executive body to address a general session of the next convention on the subject of land economics and its relation to agricultural development.

The report of the committee on experiment station organization and policy dealt with two matters. It presented a code of ethics for experiment station workers, based in considerable part on discussions of the subject in the association meetings from time to time. It also recommended a plan for securing more definite and reliable information regarding the amounts of money employed by the stations in experiments and research as distinguished from other forms of activity. The advantages of such data both to the individual institution and to the system as a whole were emphasized, but it was pointed out that under present conditions even an approximate estimate is very difficult. Fully a third of the stations omit from their annual reports a statement of their revenues or give only those from Federal funds. In many States the stations have no budget of their own or specific appropriations for their use, about a third receiving their State aid through an allotment by the college authorities from general appropriations to the institution.

In order to obtain data on the use made of its resources, the committee recommended that the Office of Experiment Stations be authorized to request each station to report annually the amounts of the State and other supplementary funds expended for (a) research and experimentation, (b) regulatory work, such as inspection and analy-

sis, stallion registration, and advanced registry tests, (c) public service and advisory work, such as that of the State entomologist, health and sanitation laboratories, marketing service, etc., (d) soil and similar surveys, (e) management of farms and other commercial enterprises, and (f) capital outlay, and any other classes of expenditures not embraced in those mentioned. It was recognized that this would involve the inauguration by each station of some system of records or accounting which would segregate these expenditures through the year with approximate accuracy, but it was felt that this should not be a particularly difficult task and would lead to a much clearer conception of the station activities apart from research than would obtain otherwise.

The joint committee on projects and correlation of research presented a report of steps taken by the executive committee of the association and the committee itself to develop and maintain the closest possible relations between the research work of the Federal Department of Agriculture and that of the stations. Incorporated in its report was a letter sent by the Secretary of Agriculture to the governors of the various States in February, 1923, stating that "our research work, if done in cooperation with the States, is carried on with the experiment stations of the agricultural land-grant colleges." The committee reported, moreover, that the Department stood ready, through its director of scientific work, to coordinate its work with that of the colleges and stations so far as practicable, and would endeavor to cooperate when new work is to be undertaken in a State. It was recognized, however, that the details of any policy must necessarily be worked out between the Secretary and the association, and the committee accordingly recommended that the executive committee be asked to confer with the Secretary with a view to formulating a general memorandum of understanding which would carry into effect the general policy of efficient cooperative relations regarding agricultural research. This recommendation subsequently received the endorsement of the executive committee and the executive body.

The report of the joint committee on publication of research announced that one hundred and twenty-seven papers had appeared in the *Journal of Agricultural Research* since its resumption of publication last January. Forty-seven of these papers originated with twenty-four of the stations, and eighty papers with the Department of Agriculture. It was felt that the restoration of this channel of publication has been a material assistance in the publication of agricultural research.

Another encouraging development of the convention from the viewpoint of research was the increasing interest shown in research in home economics. This was reflected in a statement by Dr. Louise

Stanley, chief of the new Bureau of Home Economics, that "the most hopeful aspect seems to be the general realization of the fact that a sound program for resident and extension teaching must be based on research." As regards increased financial provision, she expressed the view that "funds must be justified by a greater evidence of the research spirit, by more well-conducted researches in the various fields, by a larger proportion of the people on the home economics staffs participating in research, and by a better trained group of women to do the work."

The question was also considered by the committee on college organization and policy, which recommended that "attention be focused as a matter of college policy upon the need for a comprehensive program of research as the indispensable basis for sound resident teaching in home economics, upon the necessity of securing financial support commensurate with the importance of the subject, upon the desirability of avoiding unnecessary duplication, and upon the vital importance at all times of the fundamental sciences underlying home economics." This recommendation was referred by the executive body to the executive committee for action, with a view to arranging for a preliminary survey of the field of home economics research and a report of its findings to the next convention.

The presidency of the association was bestowed upon President Pearson, with Director G. I. Christie of Indiana vice president. President W. B. Bizzell of Texas was elected to succeed President Pearson on the executive committee. The remaining members of this committee and the secretary-treasurer were continued unchanged. A complete list of the officers and committee changes is given in the notes of this issue.

In accordance with the decision of the executive body in 1922 to hold its conventions of the even years in Washington, D. C., the next annual meeting was announced for that city. The date set is November 12–14, 1924.

The Chicago convention was an interesting gathering, one of the most representative of recent years and one with its outlook quite definitely toward the future. There was brought before it no single outstanding issue, but opportunity was afforded for the consideration of several questions of importance, and on most of these tangible progress was recorded. That the land-grant colleges are more and more realizing their responsibilities in agricultural leadership seems quite apparent. They are increasingly disposed to provide broad training and enlightened motivation for their students and to improve the pedagogic quality of their instruction. They are realizing more and more how necessary is research as a corner stone of an adequate agricultural program, and how vital is its encouragement and consistent development.

RECENT WORK IN AGRICULTURAL SCIENCE.

AGRICULTURAL CHEMISTRY—AGROTECHNY.

Simplified apparatus and technique for the electrometric determination of H-ion concentration in milk and other biological liquids, F. E. Rice and A. J. Rider (*New York Cornell Sta. Mem. 66 (1923), pp. 3–16, fig. 1*).—This publication reports the results of a critical study of various recommendations concerning apparatus and technique for electrometric H-ion concentration determinations, with particular reference to work with milk and other biological liquids. The apparatus and procedure which have been developed to fulfill the various conditions and found most satisfactory are described in detail. The apparatus as illustrated by the accompanying diagram (fig. 1) is essentially as follows:

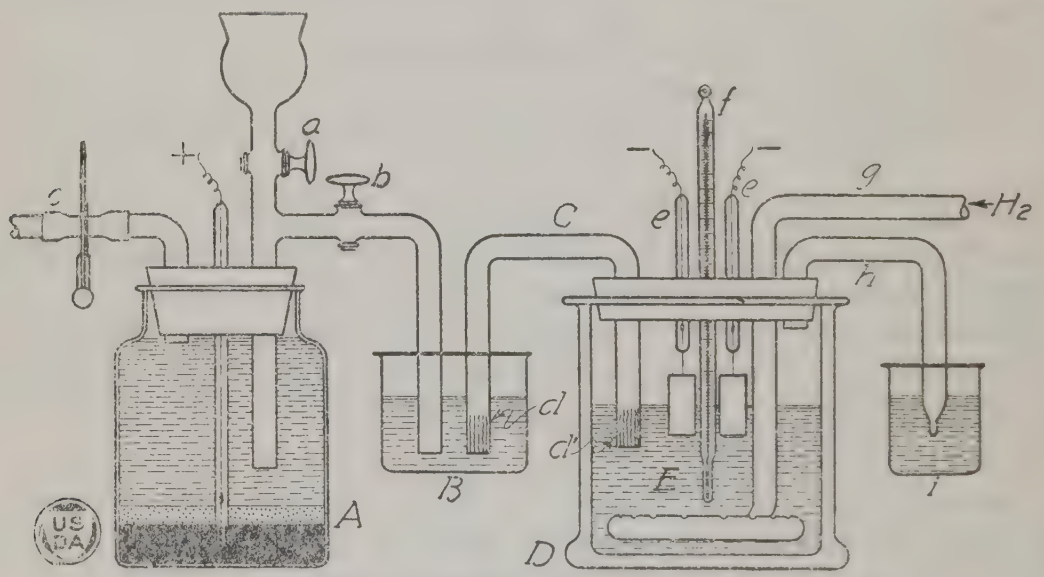

Fig. 1.—Apparatus for determination of H-ion concentration.

The calomel cell A contains a layer of mercury covered with a layer about 5 mm. thick of a paste consisting of purified calomel with a little mercury moistened with N/10 KCl solution. The cell is then filled with N/10 KCl previously saturated with calomel. The electrode consists of a short piece of platinum wire soldered to the end of a copper wire which is thrust through a glass tube until the platinum protrudes at one end, this end being then sealed. The stopcock *b* of the siphon tube is left ungreased and kept closed during the reading, thus providing sufficient contact for the flow of current and at the same time preventing movement of the liquid through siphon action.

The hydrogen electrode cell D consists of a glass cylinder fitted with a rubber stopper provided with holes for a thermometer *f*, at least two hydrogen electrodes *e* and *e*, the hydrogen inlet and outlet tubes *g* and *h*, and the tube C connected with the saturated KCl cell B. One of the distinguishing fea-

tures of the cell consists of the arrangement for the use of several hydrogen electrodes, thus allowing check determinations to be made readily. Another feature is the hydrogen inlet tube *g* which terminates in a perforated horizontal ring, which distributes the flow of hydrogen through the body of the liquid and thus does away with the necessity of shaking the electrode vessel. The hydrogen outlet tube *h* may or may not be immersed in a beaker of water, *i*.

The hydrogen electrodes themselves consist of flat pieces of platinum 1 to 2 cm. square welded to platinum wire. The surface is cleaned with aqua regia or chromic acid mixture and rinsed with water, and platinum black is then deposited on the foil by using two foils as anode and cathode, respectively, in a 3 per cent solution of chlorplatinic acid.

In making H-ion concentration determinations with this apparatus, the sample is placed in the hydrogen electrode vessel with the electrodes adjusted so that the foils are about half submerged, the proper connections are made from the mercury and platinum poles to the potentiometer, and a rapid flow of hydrogen is maintained throughout the experiment. The first readings are taken after a few minutes and continued from time to time, using first one electrode and then the other until the readings are constant. Further accuracy can be secured by using more than one calomel cell. The method finally adopted for temperature control consisted in immersing the hydrogen electrode vessel in a water bath at 25° C. while making the determination, and not allowing the temperature of the room to fall below 20°.

Data are presented on determinations of the H-ion concentration of a standard solution of acid potassium phthalate of a pH value of 6.711, using 6 hydrogen electrodes, 2 at a time, with 5 determinations for each pair. The averages of the 5 determinations for each of the 6 electrodes were 6.709, 6,709, 6.706, 6.706, 6.709, and 6.709. In 444 out of 459 determinations on samples of raw milk and reconstituted evaporated and powdered milk, identical results were obtained with the 2 electrodes, while in the remaining 15 cases variations in pH values between 0.007 and 0.017 were obtained.

The apparatus is recommended for experimentation on all biological liquids except in cases in which carbon dioxid is of prime importance. It is thought to be adapted for use in student laboratories, as well as in research work, and with slight modifications to electro-titrations.

Specific acidity of water extract and oxalate content of foliage of African sorrel, G. P. WALTON (*Bot. Gaz., 74 (1922), No. 2, pp. 158–173, fig. 1*).—In connection with an examination of the leaves of a native African sorrel, *Rumex abyssinicus*, with a view to their edibility, a scheme of analysis for determining the source of acidity of materials of an acid character was developed which is recommended as being of value to food and drug analysts as a simple and rapid procedure for determining the nature of acidity.

The procedure consists essentially in determining first the total or titratable acidity of a water extract of the material, allowance being made for the water naturally present in the green material. This is followed by a colorimetric determination of the H-ion concentration according to the method described by Gillespie (E. S. R., 43, p. 211), but using the color standards of Medalia (E. S. R., 44, p. 411). The pH values are converted into specific acidity values according to the system of Wherry (E. S. R., 41, p. 205). A preliminary examination of the leaves having shown the nature of the acid radical, a comparison is made of the specific acidity and pH values of pure solutions of substances suspected of being the source of this acidity. The conclusions drawn from this comparison can be checked by a crystallographic examination by polarized light of the dried and ground material.

In the present instance the substances identified were calcium oxalate monohydrate, and potassium binoxalate.

Proteins of the cantaloup seed, Cucumis melo.—Isolation of a crystalline globulin, and a comparative study of this globulin with the crystalline globulin of the squash seed, Cucurbita maxima, D. B. JONES and C. E. F. GERSDORFF (*Jour. Biol. Chem., 56 (1923), No. 1, pp. 79–96, figs. 2*).—The protein studies at the Bureau of Chemistry, U. S. D. A., have been extended to an examination of the proteins of the cantaloup seed (*C. melo*). By extraction of the ether-extracted meal of the hulled seeds with 2 per cent aqueous sodium chlorid at 60° C., 28.21 per cent of globulin was obtained. This separated from the salt solution on cooling in octahedral crystals of the following percentage composition; C 52.65, H 6.67, N 18.41, and S 1.13 per cent. As analyzed by the Van Slyke method, the following amounts of diamino acids were obtained: Arginin 16.26, histidin 4.22, lysin 3.29, cystin 1.27, and tryptophan 2.63 per cent. In chemical, physical, and immunological properties this globulin could not be distinguished from the globulin of the squash seed similarly prepared.

From an ether-extracted meal containing the hulls, 5.78 per cent of glutelin was obtained on extraction with 0.5 per cent sodium hydroxid. This glutelin had the following composition: C 55.20, H 7.02, N 16.28, and S 0.90 per cent; arginin 12.42, histidin 2.72, lysin 4.59, cystin 1.09, and tryptophan 3.03 per cent.

The preparation of tryptophan from the products of hydrolysis of lactalbumin with baryta, H. C. WATERMAN (*Jour. Biol. Chem., 56 (1923), No. 1, pp. 75–77*).—The author recommends hydrolysis with barium hydroxid in place of trypsin digestion for the isolation of tryptophan from proteins by the direct isolation procedure of Hopkins and Cole. The technique as applied to the determination of tryptophan in lactalbumin is described in detail. In the application of the method to the determination of tryptophan in lactalbumin prepared from casein a yield of 1.45 per cent of tryptophan on the basis of ash and moisture-free lactalbumin was obtained.

A new sulphur-containing amino acid isolated from the hydrolytic products of protein, J. H. MUELLER (*Jour. Biol. Chem., 56 (1923), No. 1, pp. 157–169*).—A further study is reported of the new sulphur-containing amino acid found to be present in the hydrolytic products of casein (E. S. R., 47, p. 584) and of other proteins, including egg albumin and edestin. The methods of isolating the amino acid from hydrolyzed casein and from egg albumin are described in detail, together with attempts made to determine its chemical properties and structure. The acid apparently has the formula $C_5H_{11}SNO_2$, but its definite structure has not been determined.

Determination of amino nitrogen in compounds reacting slowly with nitrous acid, D. W. WILSON (*Jour. Biol. Chem., 56 (1923), No. 1, pp. 183–190, figs. 2*).—Determinations of the amino groups reacting slowly with nitrous acid by the Van Slyke method are reported. The rates of reaction were determined at from 21 to 26° C. over periods of from 3 minutes to 5 hours, with the following results:

"Guanin, guanosin, and guanylic acid yield in 1 to 2 hours amounts of gas varying from 8 to 27 per cent above the theoretical for one reacting nitrogen. Adenin and adenin nucleotid both yield the theoretical amount of nitrogen in 1 to 2 hours. Xanthin and hypoxanthin produce traces of gas, but uric acid does not. Cytosin yields 37 per cent more than the quantity of gas produced by one reacting nitrogen. Thymin, uracil, and uridin do not react with nitrous acid. Two atoms of nitrogen in allantoin react slowly and continuously, the reaction not being complete in 5 hours. One atom of nitrogen in creatinin reacts with nitrous acid in 1 hour. The presence of creatinin may account

for one-third of the blank in the determination of amino nitrogen in urine by by Van Slyke's method."

The determination of free amino nitrogen in proteins, D. W. WILSON (*Jour. Biol. Chem., 56 (1923), No. 1, pp. 191–201*).—Some of the advantages and disadvantages of the Van Slyke and the Sörensen formol titration methods for determining amino acids are discussed, the literature on the comparison of these methods is reviewed briefly, and experimental data are reported in parallel determinations by the two methods of seven different proteins. In the Van Slyke method the micro apparatus was used, and the reaction was allowed to continue for varying lengths of time.

The tabulated data show a continuous increase in the values obtained by the Van Slyke method with increasing length of reaction, while no single period of reaction yielded results with all of the preparations similar to those obtained by the Sörensen method. The Van Slyke method is thought to be subject to error in two directions, (1) in occasionally yielding results which are too high, due probably to hydrolysis, and (2) in yielding results which are too low with certain proteins which are too insoluble in the nitrous acid. The Sörensen method is thought to be less susceptible to error in the analysis of proteins.

On the nature of the sugar in blood, L. B. WINTER and W. SMITH (*Jour. Physiol., 57 (1922), No. 1–2, pp. 100–112, figs. 3*).—The plan followed in this study of the nature of the sugar in the blood was to separate the proteins from the blood and determine the polarization and copper-reducing values of the resulting filtrate. The copper reduction method used was a modification of the Bertrand method.

In all the samples of normal blood examined, including ox, sheep, cat, rabbit, and human blood, the polarimetric values gave lower results than the copper reduction values when both were calculated as glucose, if the determinations were made within five hours after the beginning of the protein precipitation. If the filtrate was allowed to stand and the readings were taken from time to time, the polariscope readings gradually approached the values obtained by the copper reduction method.

These results are thought to confirm the conclusion of Hewitt and Pryde (E. S. R., 44, p. 259) that sugar in the blood is an unstable form of γ-glucose. That the conversion of food sugar into this form is very rapid is shown by the fact that glucose and fructose when taken in large quantities per os can not be detected as such in the blood.

The blood sugar of persons suffering from severe diabetes mellitus appeared to be of a different form from that in normal persons, the polarization values finally reaching those of the α- and β-form of glucose. It is suggested that the pancreas under normal conditions secretes an enzym capable of converting the α- and β-form of glucose into γ-glucose, and that in diabetes this enzym is inactive or absent.

The influence of alkaline earths on the determination of reducing sugars by Fehling's solution, L. EYNON and J. H. LANE (*Jour. Soc. Chem. Indus., 42 (1923), No. 14, pp. 143 T–146 T; abridged in Internatl. Sugar Jour., 25 (1923), No. 294, pp. 305–308*).—Experimental evidence is presented that the presence of the salts of the alkaline earth metals leads to low results in both the volumetric and gravimetric methods of determining sugars. Since calcium salts are present in raw cane and beet sugars, sirups, and molasses, and occasionally in starch sugar, it is considered imperative to remove these salts before determining the reducing sugars. Of various precipitants tested, sodium or potassium oxalate was found to be the most satisfactory, 5 cc. of a 10 per cent solution being sufficient to remove all of the calcium salts likely to be present in 10 gm.

of a sample of molasses. To assist in filtration, the addition of a small quantity of alumina cream after the addition of the oxalate is recommended.

Attention is called in this connection to previous work of Meade and Harris (E. S. R., 35, p. 616), in which it was reported that deleading agents other than potassium oxalate gave lower results than those obtained with potassium oxalate. More recent work is also cited dealing with the effect of potassium oxalate on the copper-reducing power of sugars.

Résumé of the physico-chemical analysis of milk, A. V. Eeckhout (*Résumé du Cours d'Analyse Physico-Chimique du Lait. Ixelles-Brussels: G. Bothy, 1923, pp. 72, pls. 8*).—The physical and chemical properties of normal milk are discussed, and tests are described for determining such characteristics as density, viscosity, freezing point, acidity, fat, protein, and ash, as well as tests for impurities and preservatives, such as foreign fats, formalin, carbonate of soda, and boric acid. The normal variation that may be expected in the composition of milk, for use in determining adulteration, is also noted.

On the endothermic reaction which accompanies the appearance of a visible curd in milks coagulated by heat: A contribution to the theory of the heat coagulation of milk, A. Leighton and C. S. Mudge (*Jour. Biol. Chem., 56 (1923), No. 1, pp. 53–73, figs. 4*).—In this contribution from the Dairy Division, U. S. D. A., data are presented showing that the process of heat coagulation of milk is accompanied by an endothermic chemical reaction involving the precipitation of calcium and magnesium, and that the thickening upon standing at room temperature of sterile, highly concentrated, sweetened and unsweetened condensed milk is a similar reaction instead of a bacteriological effect.

It is also shown that preliminary forewarming of evaporated milk for a 10 minute period at 95° C. stabilizes, at 110° slightly unstabilizes, and at 120° decidedly unstabilizes the finished product. The reverse is true for condensed milk. A preliminary forewarming for 10 minutes at 95° unstabilizes, at 110° slightly stabilizes, and at 120° decidedly stabilizes the finished product. A prolonged forewarming of condensed milk at 95° tends eventually to stabilize it.

It is concluded that the controlling factor determining the stability of milks toward the action of heat is the equilibrium of the salts of the milk and that the sugar exerts a definite effect upon this equilibrium.

A study of the factors that influence the coagulation of milk in the alcohol test, H. H. Sommer and T. H. Binney (*Jour. Dairy Sci., 6 (1923), No. 3, pp. 176–197, figs. 3*).—An extensive study is reported from the Wisconsin Experiment Station of the factors influencing the alcohol test for grading milk. Both 70 and 75 per cent alcohol by volume were used in the various tests reported. The alcohols were distilled in the presence of sodium hydroxid and adjusted to specific gravities at 15° C. of 0.89 for the 70 and 0.8773 for the 75 per cent alcohol. The test was made in the usual manner by adding 2 cc. of the milk to 2 cc. of alcohol in a test tube, closing the test tube with the thumb, inverting it several times, and examining it for the appearance of a precipitate.

The effect of various salts present in milk was first examined by adding solutions of these salts in known amounts to a definite volume of milk and then conducting the alcohol test. A slight increase in the calcium or magnesium content of the milk gave rise to a positive reaction, while an increase in potassium, sodium chlorid, citrate, and phosphate had no effect. On testing these salts in various combinations, it was found that the effect of the calcium and magnesium could be counteracted by certain proportions of citrates and phosphates, thus showing that one of the factors responsible for positive or negative values in this test is the proportion of the different salts present. On feed-

ing liberal amounts of calcium carbonate to three cows, the milk of which had previously given a negative test became positive.

The relation of acidity was next studied in connection with the salt effect. Three series of milk samples ranging in acidity from 0.12 to 0.38 per cent were used. The first was allowed to remain normal, while to the second and third samples were added, respectively, 0.1 cc. M/4 calcium acetate and 0.1 cc. M/4 potassium phosphate. The normal milk became positive to the alcohol test when the acidity had reached 0.26 per cent, the one containing calcium acetate at 0.2, and the one containing potassium phosphate at 0.3 per cent. These results show that the effect of the acidity and salts is additive, and that the salt effect can easily account for any discrepancy between the alcohol test, acidity, and bacterial count.

In testing for the effect of rennet, two experiments were conducted. In the first rennet was added in six dilutions to fresh milk and the milk tested every 5 minutes at first and then every 15 minutes until it became positive. Positive results were obtained in the samples containing rennet of the lowest dilution, 1:25,000, is 30 minutes, and at the highest dilution, 1:150,000, in 180 minutes. The test was repeated with sterilized milk adjusted by the addition of M/20 calcium acetate to the position of the fresh milk with respect to the coagulation point. The flasks were inoculated with a pure culture of a rennet-forming organism and incubated at 37°. When the first positive test was obtained the milk was plated on lactose agar to determine the bacterial count. The average of six samples showed a bacterial count of 855,830, which was much lower than the previously reported figures of Ayers and Johnson (E. S. R., 33, p. 113).

In discussing the significance of these results, it is pointed out that the heat coagulation of evaporated milk and the alcohol coagulation are both influenced by the same factor, excess of calcium or magnesium over citrates and phosphates. Consequently, the value of the alcohol test may be more significant in the selection of milk for condenseries than for other purposes.

The method of determining urea with hypobromites, B. M. Margosches and H. Rose (*Biochem. Ztschr., 136 (1923), No. 1–3, pp. 119–127*).—An alkalimetric hypobromite method of determining the nitrogen content of urea and other ammonium compounds is described. The technique is essentially as follows:

A weighed sample, which should contain from 0.02 to 0.03 gm. of urea, is mixed in a 500 cc. Erlenmeyer flask with 50 cc. of a N/10 solution of bromin in sodium hydroxid. The mixture is heated for 3 minutes in the water bath and then treated with from 0.2 to 0.3 gm. of sodium bromid and 50 cc. of hydrochloric acid in a somewhat stronger than N/5 solution. The bromin is driven off by gently heating and the solution cooled and titrated for excess acid with N/5 alkali, using methyl red as indicator. A blank test with sodium bromid is run with each determination.

Data are given on the accuracy of the method and its application to the determination of nitrogen in various ammonium salts.

Home tanning of leather and small fur skins, R. W. Frey, I. D. Clarke, and F. P. Veitch (*U. S. Dept. Agr., Farmers' Bul. 1334 [1923], pp. II+29, figs. 9*).—This publication gives directions for the home tanning of one or more hides and skins, as well as for small fur skins, with the use of simple equipment such as would be available on any farm or ranch.

Wearing qualities of shoe leathers, F. P. Veitch, R. W. Frey, and I. D. Clarke (*U. S. Dept. Agr. Bul. 1168 (1923), pp. 25, pls. 2, figs. 2*).—This is the report of a very comprehensive study of the wearing qualities of leather.

Shoes were made from definite sections of the leather according to certain War Department specifications and distributed to Army privates in Texas and New Mexico. The worn-out shoes were inspected for condition of the leather, and the soles subjected to chemical analysis for comparison with the composition of duplicate samples of unworn leather. The principal points brought out in the inspection and examination were "the superior pliability of retanned chrome and chrome-tanned upper leathers, the objectionable features of fiber soles and the long wear of those that did not develop such features, the increased serviceability of rolled veegtable-tanned sole leathers, and the strikingly longer wear of chrome-tanned sole leathers, especially of the unwaxed chrome-tanned leather."

METEOROLOGY.

The Weather Bureau, H. E. WILLIAMS, revised by E. B. CALVERT (*U. S. Dept. Agr., Weather Bur., 1923, rev. ed., pp. IV+55, figs. 11*).—This is a revision of a pamphlet, first issued in 1915 (E. S. R., 33, p. 717), giving a brief historical account of the Weather Bureau and explaining the nature of its work.

Monthly Weather Review (*U. S. Mo. Weather Rev., 51 (1923), Nos. 5, pp. 239–290, pls. 10, figs. 17; 6, pp. 291–344, pls. 12, figs. 14*).—In addition to detailed summaries of meterological, climatological, and seismological data and weather conditions for May and June, 1923, and bibliographical information, reprints, reviews, abstracts, and minor notes, these numbers contain the following contributions:

No. 5.—A New Form of Thermoelectric Recording Pyrheliometer (illus.), by H. H. Kimball and H. E. Hobbs; Sun Spots and Terrestrial Temperature in the United States (illus.), by A. J. Henry (see below); Some Characteristics of Texas Rainfall (illus.), by I. R. Tannehill; Panama Climate, by R. Z. Kirkpatrick (see p. 719); Concerning Halos of Abnormal Radii, by L. Besson; Comments on Halos of Unusual Radii, by W. J. Humphreys; Winds and Weather of Central Greenland: Meteorological Results of the Swiss Greenland Expedition (illus.), by C. F. Brooks; Snowstorm of May 8–9, 1923, in Michigan (illus.), by B. B. Whittier; Snowstorm of May 9, 1923, in the Saginaw Valley, Mich., by F. H. Coleman; Tornado in Davidson County, Tenn., May 12, 1923, by R. M. Wiliiamson; Tornado at Little Rock, Ark., May 14, 1923 (illus.), by H. S. Cole; Small Tornado at Thrall, Tex., May 14, 1923, by W. D. Fuller; Torrential Rains in Extreme Southeastern Texas (illus.), by E. Carson; The Clonmel Tornado of May 22, 1923, by J. W. Arnold; and Veering or Backing Winds as Indicating the Weather, by E. P. Jones.

No. 6.—Rainfall Interpolation (illus.), by R. E. Horton; Concerning the Relation Between the Duration, Intensity, and the Periodicity of Rainfall (illus.), by P. P. Gorbatchev (see p. 719); City Planning and the Prevailing Winds, by C. J. Root; Stimulus and Conservation of Energy as Bases of Medical Climatology (illus.), by F. Baur; Fata Morgana on the Nagyhortobágy (illus.), by A. Réthly; Mirage in Lower California, by J. H. Gordon; Small Tornadoes Near Cheyenne, Wyo. (illus.), by G. W. Pitman; Tornadoes in New Mexico, June, 1923, by C. E. Linney; Tornado at Roswell, N. Mex., by C. Hallenbeck; Dustfall at Ludington, Mich., March 25, 1923, by C. H. Eshleman; and Heavy Rains in Southern Kansas, June, 1923, by A. J. Henry.

Sun spots and terrestrial temperature in the United States, A. J. HENRY (*U. S. Mo. Weather Rev., 51 (1923), No. 5, pp. 243–249, figs. 5*).—Summarizing the results of previous studies by others on this subject, the author states

that "it appears that the weight of evidence is in favor of the existence of a variation in the air temperature of the globe corresponding roughly with that of the spottedness of the sun, an increase in spots corresponding with diminished terrestial temperatures and vice versa. The amplitude of the variation is, however, small, as has been shown by several investigators, and amounts to less than a degree centigrade in the mean of the year. It is best exemplified in the Tropics and is uncertain and difficult to trace in temperate latitudes."

Analyzing temperature data for the United States for 111 years, 1810–1921, the author concludes that the annual temperature deviations furnish some evidence of a similar correlation, which, however, is not always consistent and definite. An outstanding feature of the study is the evidence it furnishes of short period variations within the 11-year sun-spot cycle. The results confirm the author in his belief that "while terrestial temperature is primarily controlled by the output of solar radiation, the immediate control which results in the day-to-day weather is almost wholly the result of horizontal convection or flow of air from low to higher latitudes and vice versa."

Concerning the relation between the duration, intensity, and the periodicity of rainfall, P. P. GORBATCHEV (*U. S. Mo. Weather Rev., 51 (1923), No. 6, pp. 305–309, figs. 3*).—The author develops a formula for calculating the so-called "rain power" of storms as a basis for their classification. The question of the accuracy of the formula and its applicability are briefly discussed by H. R. Leach and R. E. Horton.

Meteorological observations at the Massachusetts Agricultural Experiment Station, J. E. OSTRANDER and H. H. SHEPARD (*Massachusetts Sta. Met. Buls. 415–416 (1923), pp. 4 each*).—Summaries of observations at Amherst, Mass., on pressure, temperature, humidity, precipitation, wind, sunshine, cloudiness, and casual phenomena during July and August, 1923, are presented. The data are briefly discussed in general notes on the weather of each month.

Panama climate, R. Z. KIRKPATRICK (*U. S. Mo. Weather Rev., 51 (1923), No. 5, pp. 253, 254*).—In this brief descriptive note it is stated that "the climate of Panama is approximately that of July in the North Atlantic States from Virginia to New Hampshire, except that during the rainy season it has more rain and humidity."

SOILS—FERTILIZERS.

Soil survey of Duval County, Fla., A. E. TAYLOR and T. J. DUNNEWALD (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1921, pp. III+21–48, fig. 1, map 1*).—This survey deals with the soils of an area of 500,480 acres in the northeastern corner of Florida. It consists of an almost level to gently undulating flatwoods region, broken by low, isolated ridges and by belts of low, narrow ridges along the coast, the St. Johns River, and its principal tributaries.

The soils of the county are prevailingly sandy and poorly drained, although in topography and drainage there is a range from shallow, undrained basins through flat, poorly drained to excessively drained ridges. Including tidal marsh, swamp, peaty muck, coastal beach, and made land, 16 soil types of 10 series are mapped, of which the Leon, Norfolk, and Bladen fine sands cover 23.6, 18, and 13.1 per cent of the area, respectively.

Soil survey of Emmet County, Iowa, D. S. GRAY and F. W. REICH (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1920, pp. III+409–443, fig. 1, map 1*).—This survey, made in cooperation with the Iowa Experiment Station, deals with the soils of an area of 251,520 acres in north-central Iowa. The

topography varies from nearly flat or undulating to rolling, with some strongly rolling country along most of the West Fork Des Moines River and continuing west. First-bottom lands occur along this and other streams in the county. Natural drainage is good in the more strongly rolling country, but a large part of the county needs artificial drainage.

The county lies within the glaciated region, and the upland soils are developed through weathering from the underlying Wisconsin drift. The soils are divided into upland glacial, terrace, and first-bottom soils, and muck and peat. Including muck, peat, meadow, and gravel pits, 18 soil types of 8 series are mapped, of which the Clarion loam covers 69.8 per cent of the area.

Soil survey of St. Joseph County, Mich., L. C. WHEETING and S. G. BERGQUIST (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1921, pp. III+49–72, pls. 4, figs. 2, map 1*).—This survey, made in cooperation with the Michigan Experiment Station, deals with the soils of an area of 321,920 acres lying within the glaciated region on the southern boundary of the lower peninsula of Michigan. The most striking physiographic feature of the county consists of the outwash plains. The area of drift unmodified by reworking the moraines is not extensive. The greater part of the area consists of a nearly level plain.

The soils of the county are derived entirely from glacial material, which in some cases was left in rough, hilly areas of unassorted drift and in other places in widespread outwash plains of assorted materials. The drift averages about 300 ft. in depth and is correlated with the late Wisconsin. Limestone is the chief constituent of the drift and sandstone and other rocks have contributed a part of the materials. The texture of the derived soils is uniformly light, loam being the heaviest class mapped in the county. Including muck, 16 soil types of 12 series are mapped, of which the Fox sandy loam, Bellefontaine sandy loam, muck, and Plainfield sandy loam cover 33.2, 19.9, 13.9, and 11.2 per cent of the area, respectively.

Soil survey of Smith County, Miss., W. E. THARP and W. DEYOUNG (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1920, pp. III+445–492, fig. 1, map 1*).—This survey, made in cooperation with the Mississippi Geological Survey, deals with the soils of an area of 403,840 acres in the Coastal Plain region in south-central Mississippi. The surface is rolling to hilly with rather small areas that are very rough. It is stated that very complete drainage systems have developed, and the surface for the most part consists of interstream divides with innumerable secondary ridges.

Sand and sandy clay soils are said to predominate through the southern and central parts of the county, while heavy clays with some irregularly distributed sands overlying them are the chief soil-forming materials of the northern part. Twenty-eight soil types of 17 series are mapped, of which the Ruston and Orangeburg fine sandy loams cover 37.6 and 18.9 per cent of the area, respectively.

Soil survey of the Bernardsville area, N. J., A. L. PATRICK ET AL. (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1919, pp. IV+409–468, pls. 3, fig. 1, map 1*).—This survey, made in cooperation with the Department of Conservation and Development of New Jersey, deals with the soils of an area of 464,000 acres in central northern New Jersey, comprising nearly all of Morris and Somerset Counties and small parts of Middlesex, Union, Essex, Sussex, and Hunterdon Counties. The area lies within the Coastal Plain, Highlands, and Piedmont Plain. These divisions differ in topography, ranging in surface characters from low-lying plains to high ridges, mountains, and valleys. As a whole the drainage is good, but in many places in the Passaic Basin natural drainage is poorly developed.

The soils of the area lie in seven soil provinces, viz, Piedmont, Appalachian Mountain, Coastal Plain, Glacial, Glacial Lake and River Terrace, Limestone Valleys, and River Flood Plains. Including muck, rough stony land, tidal marsh, and clay pits, 40 soil types of 23 series are mapped, of which the Chester loam and Penn silt loam cover 15 and 14.3 per cent of the area, respectively.

Soil survey of Wayne County, N. Y., C. VAN DUYNE ET AL. (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1919, pp. IV+273–348, fig. 1, map 1*).—This survey, made in cooperation with the New York State College of Agriculture, deals with the soils of an area of 383,360 acres in north-central New York. The surface of the area is undulating to rolling. The county comprises two distinct physiographic divisions—the drumlin region, with its systematic arrangement of elongated hills and valley troughs, and the lake plain, a level to undulating or rolling region which was wholly or partly submerged by lake waters during glacial times. The county is said to be on the whole well drained.

The soils are classed into seven groups as soils derived from glacial till, the decomposition of the underlying rocks, terrace, and beach deposits, lake-laid sediments, recent-alluvial material, accumulations of organic matter, and from miscellaneous material. The glacial till soils are the most extensive, covering about three-fourths of the county, followed by the terrace and lake-laid soils. Including muck, marsh, made land, coastal beach, and peat, 42 soil types of 20 series are mapped, of which the Ontario loam is the most extensive, covering 34.9 per cent of the area.

Soil survey of Josephine County, Oreg., A. E. KOCHER and E. F. TORGERSON (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1919, pp. III+349–408, pls. 3, fig. 1, map 1*).—This survey, made in cooperation with the Oregon Experiment Station, deals with the soils of an area of 489,600 acres in southwestern Oregon. The area consists of rugged mountains with steep, heavily woodel slopes and a number of smoothly terraced valleys. The mountains constitute by far the greater part of the area. The area is said to be well drained.

The soils are of residual and transported origin. With the exception of those on small areas of somewhat poorly drained land, the soils are light in color, are free from accumulation of salts or of lime carbonate, possess, as a rule, heavier subsoils than soils, and have developed under forest cover. Including rough, mountainous land, rough stony land, river wash, and placer diggings, 24 soil types of 15 series are mapped, of which rough mountainous land and rough stony land together cover 53.7 per cent of the area. The Columbia fine sandy loam and the Josephine clay loam are the most extensive classified types.

Soil survey of Erath County, Tex., T. M. BUSHNELL ET AL. (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1920, pp. III+371–408, fig. 1, map 1*).—This survey, made in cooperation with the Texas Experiment Station, deals with the soils of an area of 693,120 acres in the Great Plains region in central Texas. The area embraces an elevated, dissected plateau, two-thirds of which slopes gently southeast from the main divide and one-third descends through abrupt breaks toward the north and east. The drainage is said to be complete.

The soils are of residual and alluvial origin. The nature and distribution of the various soils depend largely upon the four principal geological strata exposed in the county. There are two limestone and two sandstone formations, which give rise to calcareous heavy soils and noncalcareous sandy soils. The former have a growth of prairie grasses, live oak, and mesquite trees, while the latter bear post oak and blackjack oak. The alluvial soils of the county include old well-weathered deposits now above overflow, and more recent deposits which are more or less subject to overflow. All these soils are at

least moderately calcareous and were originally in forest. Including rough stony land, 21 soil types of 10 series are mapped, of which the Windthorst fine sandy loam, Denton stony clay, and Denton clay cover 29.5, 18.7, and 12.4 per cent of the area, respectively.

The microscopic estimation of colloids in soil separates, W. H. FRY (*Jour. Agr. Research [U. S.], 24 (1923), No. 10, pp. 879–883*).—In a contribution from the Bureau of Soils, U. S. D. A., a microscopic method for estimating the quantity of colloidal soil aggregates in soil separates is described which was evolved in recent studies on absorption by colloidal and noncolloidal soil constituents (E. S. R., 48, p. 318). This method was applied to the residues left after extracting, by repeated rubbing and washing, all colloid possible from eight samples of soil.

The results showed that from 34.5 to 60.2 per cent of the total colloidal material in the soil was in the form of colloidal aggregates not extractable by washing and rubbing.

Soil acidity as measured by sugar inversion, the Truog test, and the H-ion concentration, and its relation to the hydrolysis of ethyl acetate, F. W. PARKER and O. C. BRYAN (*Soil Sci., 15 (1923), No. 2, pp. 99–107, figs. 2*).—The results of studies conducted at the University of Wisconsin, in which the reactions of 42 soils obtained by the H-ion determination, the sugar inversion method, and the Truog soil acidity test were compared, are reported.

A fairly good correlation was established between the results of the three methods. The Truog test and sugar inversion method correlated very well with each other, and in a general way both correlated fairly well with the H-ion concentration. Acid silicates catalyzed the inversion of cane sugar and caused the greater part of the sugar inversion in suspensions of acid soils. Acid silicates did not catalyze the hydrolysis of ethyl acetate in soil suspensions.

Some relationship between H-ion, OH-ion, and salt concentrations and the growth of seven soil molds, H. W. JOHNSON (*Iowa Sta. Research Bul. 76 (1923), pp. 307–344, figs. 8*).—Studies on the inhibiting effect of H-ion, OH-ion, and salt concentrations on the growth of seven molds are reported. An attempt was also made to determine the optimum reaction for mold growth.

The acid and alkaline reactions inhibiting growth of the seven molds were, respectively, pH 3.2 to 3.4 and pH 8.7 to 9.2 for *Mucor glomerula;* pH 2 to 2.2 and pH 9.2 to 11.2 for *Fusarium bullatum;* pH 1.6 to 1.8 and pH 9 to 9.3 for *Aspergillus oryzae;* pH 1.8 to 2 and pH 9.2 to 11.1 for *F. oxysporum;* pH 1.6 to 1.8 and 10.1 to 11.1 for *Penicillium variable;* pH 1.6 to 1.8 and pH 9 to 9.3 for *A. terricola;* and pH 1.9 to 2.2 and pH 9.1 to 9.3 for *P. italicum.*

The order of the salts from the least to the most toxic, molecule for molecule, was $MgSO_4$, KCl, $MgCl_2$, NaCl, $CaCl_2$, Na_2SO_4, Na_2CO_3, and K_2CO_3. In the same order, according to grams per liter of media, they were $MgSO_4$, Na_2SO_4, KCl, $MgCl_2$, $CaCl_2$, NaCl, K_2CO_3, and Na_2CO_3. The molds withstood greater concentrations of these salts, with the possible exception of K_2CO_3 and Na_2CO_3, than other organisms studied.

All the molds changed the reaction of media in which they grew, in one case a change of 6.6 in pH being noted. The acid solutions were changed to alkaline in most cases, and alkaline ones were made less alkaline. The change was not necessarily toward an optimum, as was evidenced by the fact that the changes were carried from the acid past the neutral point to alkalinity, whereas the optimum was apparently more toward the acid side.

Influence of the H-ion concentration on the growth and fixation of nitrogen by cultures of Azotobacter, P. L. GAINEY and H. W. BATCHELOR (*Jour. Agr. Research [U. S.], 24 (1923), No. 9, pp. 759–767, fig. 1*).—Studies

conducted at the Kansas Experiment Station on the influence of the H-ion concentration of laboratory culture media upon the growth and nitrogen-fixing ability of pure cultures of Azotobacter are reported.

The results agreed very closely with previous findings in soil (E. S. R., 48, p. 19; 49, p. 619), and pointed very definitely to a limiting H-ion concentration of pH 5.9 to 6 for the various cultures of Azotobacter used when grown under these experimental conditions. Vigorous growth and nitrogen fixation took place at pH 6.1 to 6.5, the optimum pH for nitrogen fixation apparently being somewhat higher than the optimum for growth. Very slight, if any, changes in the reaction of the media were produced by the growth of the various strains of Azotobacter studied, indicating the production of inappreciable quantities of acid or basic metabolic by-products.

It is concluded that this group of organisms will not exist and function in soils the H-ion concentration of which is greater than pH 5.9 to 6.

Microbiological analysis of soil as an index of soil fertility.—IV, Ammonia accumulation (ammonification), S. A. WAKSMAN (*Soil Sci., 15 (1923), No. 1, pp. 49–65*).—In a further contribution to the subject from the New Jersey Experiment Stations (E. S. R., 48, p. 816), studies are reported the purpose of which was to compare the various methods in use for the study of ammonification in soils, and to establish whether or not the phenomena in question can actually be used as soil biological functions.

The results are taken to indicate that ammonification in solution can not be used for soil differentiation, since of the three large groups of microorganisms only the bacteria develop in solution, while the fungi and actinomycetes do not usually develop because of the nature of the medium and the period of incubation. Of the bacteria, those which develop are only the so-called putrefactive forms or those that are able to grow rapidly in liquid media with peptone or other protein or protein derivative as the only source of carbon and nitrogen. These forms are usually present in all soils independent of their individual fertility. Furthermore, even where differentiation between soils is obtained it may be due more to the presence or absence of certain minerals in the soil introduced as an inoculum rather than to the particular soil flora.

No definite correlation was actually found between ammonia formation in solution on the one hand, and crop production, bacterial numbers, and nitrification on the other. It is concluded that ammonification in soil can not be used as an index of soil fertility, since all soils contain various groups of microorganisms that are able to break down complex proteins with the formation of ammonia. The final amount of ammonia accumulated in the soil is a resultant of a number of factors, among which are the nature of the protein used in carrying out the test, the presence or absence of available carbohydrates, the initial reaction of the soil and its buffer content, the rapidity with which the ammonia is transformed into nitrates, and the loss of ammonia into the atmosphere.

It is further concluded that ammonification can be used only in comparing the activities of specific cultures of microorganisms under controlled conditions and in studying the course of rapidity of decomposition of organic matter.

[Soil studies at the Iowa Station] (*Iowa Sta. Rpt. 1922, pp. 14–18*).—This is a progress report of a number of general field and greenhouse experiments to determine soil fertility requirements (E. S. R., 47, p. 721). The value of different fertilizers and rotations is discussed, and general data are presented on rotation experiments, testing soils for acidity, commercial cultures for inoculating legumes, and the value of gypsum on Iowa soils.

The Iowa system of soil management, W. H. STEVENSON and P. E. BROWN (*Iowa Sta. Bul. 213 (1923), pp. 289–318, figs. 13*).—The Iowa system of soil management is described in this bulletin on the basis of a large number of studies conducted by the station throughout the State. It is considered evident that by proper drainage and cultivation, manuring and green manuring, liming, the use of phosphates and other fertilizers, and the rotation of crops Iowa soils may be made more productive and kept so.

[Soil fertility studies by the North Carolina Station], C. B. WILLIAMS (*North Carolina Sta. Rpt. 1922, pp. 21–29*).—The progress results of soil fertility studies at the different station farms in North Carolina are briefly summarized (E. S. R., 47, p. 520). In general, the results established during previous years were apparently confirmed. Nitrogen, phosphoric acid, and lime seem to be the controlling plant nutrient factors for the mountain, Piedmont, and Coastal Plain soils, and potash seems to be quite important for the last named. Liming is especially important for the muck and peat soils.

[Experiments on maintenance of soil fertility by the Ohio Station], C. E. THORNE (*Ohio Sta. Bul. 361 (1922), pp. 325–340, 358–372, 389–408, 424–435, 451–471, 485–495, 509–521, 535–539, 554–561, figs. 3*).—Data on the results of soil fertility experiments at the nine Ohio county experiment farms are reported.

Miami County farm (pp. 325–340).—Data from five rotations on yellow and black clay loam soils are taken to indicate the possibility of increasing the total net earnings of the farms of the county by so arranging crop rotations that at least half the corn is grown on clover sod, the clover area being increased by dropping out the timothy, by transferring most if not all the oats area to soy beans, by increasing the use of acid phosphate to about twice the quantity of all fertilizers now used, by discarding the mixed fertilizers, and by such care in the preservation and distribution of the manure produced as to realize its full value as a carrier of both phosphoric acid and potash.

Paulding County farm (pp. 358–372.—Data from four rotations on this farm indicate that phosphorus, potassium, and nitrogen are so evenly balanced in this soil that in order to produce any marked increase in yield it is necessary to add all three, either in a complete fertilizer or in manure. Apparently lime is already in excess, and also sulphur, judging from the behavior of acid phosphate, as compared with rock phosphate and bone meal.

Clermont County farm (pp. 389–408).—Data from four experiments with fertilizers, lime, and manure on crops grown in rotation on this farm show that in every case the unfertilized yields have been larger on the undrained than on the drained land, indicating that the undrained land is superior in natural fertility, but that the effect of the fertilizing materials is generally greater on the drained land. The experiments favor the judicious use of fertilizers, lime, and manure. They show further that underdrainage is a permanent addition to the potential earning capacity of this land, provided it be followed by a rational system of agriculture. Data on the valuation of manure show that if the only expense is that of getting it onto the field it is, next to clover, the cheapest of fertilizing materials for drained land.

Hamilton County farm (pp. 424–435).—Data on two rotations on this farm show that wheat yielded nearly 60 per cent more on the manured or fertilized land and over 90 per cent more on the unfertilized land when grown after potatoes than after soy beans. Acid phosphate and potassium chlorid each returned their cost with a balance of 200 per cent for acid phospate and nearly as large a percentage for the potash. Nitrogen in sodium nitrate produced practically no increase in yield over that given by phosphorus and potassium. Manure was more profitable than chemical fertilizers where its

cost was merely the labor of moving it from the stable to the field, but was unprofitable when hauled from the city. The addition of acid phosphate to manure did not materially increase the effect. Ground limestone, when added to phosphated manure, increased the yield, but not sufficiently to justify the use of 2 tons of limestone per acre every 4 years at a cost of $4 per ton.

Washington County farm (pp. 451–471).—The work on this farm has been limited to a single experiment on crops grown in a 4-year rotation of corn, soy beans, wheat, and clover, and includes a special study of sheep manure. The results show that where properly handled farm manure is the cheapest fertilizer for this land if its cost be merely the labor of moving it from the stable to the field. In the absence of manure, acid phosphate produced a very profitable increase of crop, but the supplementing of sheep manure with acid phosphate did not produce sufficient additional increase to justify the cost of the phosphate. Potassium chlorid did not increase the yield. Nitrogen in sodium nitrate increased the yield, but not sufficiently to justify its cost. Since the cost of ammonia and potash in factory-mixed fertilizers is always greater than their cost in sodium nitrate and potassium chlorid, the purchase of such fertilizers is not recommended in this soil.

Trumbull County farm (pp. 485–495).—Data from a 4-year rotation of corn, oats, wheat, and clover begun on this farm in 1915 are taken to indicate that when drained the soils of the county respond promptly and profitably to a progressive system of agriculture, including systematic crop rotation and the liberal use of lime, phosphorus, and manure.

Mahoning County farm (pp. 509–521).—Data from three rotations on this farm show that the soils of the county are deficient in available phosphoric acid. Corn especially responded to a liberal use of acid phosphate and to liming, particularly on soils previously grown to clover.

Belmont County farm (pp. 535–539).—Data from a 5-year rotation, in which corn and wheat were followed by three years of clover and timothy on the hilly soils of this farm, showed a response to phosphatic fertilization and liming and indicated a need for nitrogen, which is apparently not sufficient, however, to cover the cost of nitrogen in sodium nitrate.

Madison County farm (pp. 554–561).—Data from two rotation experiments on this farm, while not conclusive, led to the assumption that acid phosphate may be used with profit. It is considered probable, however, that it will be found more economical to furnish nitrogen and potassium in farm manure than in chemical or commercial fertilizers.

Legumes in relation to soil fertility, M. J. Funchess (*Alabama Sta. Circ. 48 (1923), pp. 18, figs. 3*).—Practical information on the function of legumes in soil fertility, with particular reference to conditions in Alabama, is presented in this circular, which is based on studies conducted by the station throughout the State. It is stated that the chief needs of Alabama soils from a fertility standpoint are nitrogen and organic matter, which can be supplied most economically by the addition of both summer and winter legumes to the cropping system. The maintenance of an adequate supply of phosphorus and the use of lime on many soils are considered necessary for the most successful growth of most winter legumes.

Data on crop yields under legume treatment are presented and discussed.

Experiments on the green manuring of rice, C. S. Taylor and M. Ghosh (*Agr. Jour. India, 18 (1923), No. 2, pp. 104–114, pl. 1*).—A number of experiments on the manuring of rice soils are briefly described, special attention being drawn to the influence of phosphatic fertilizers and green manures when used alone and in combination.

It was found that the influence of phosphatic manures alone was not sufficient to pay, but that when phosphates and green manures were added in combination the results were marked. Where the phosphatic fertilizer was added to the green manure, the growth of the latter was hastened to such an extent that the fertilized plats were ready to plow in at the time of puddling. Other data on the subject are included.

The soil and crop adaptation of the New England Standard Nine grades of fertilizer, J. B. ABBOTT (*Mass. Agr. Col. Ext. Leaflet 74 [1923], pp. 5*).—This leaflet gives popular information on the practical use of the so-called New England Standard Nine grades of fertilizer in use in Massachusetts.

The effects of phosphate on early growth and maturity, C. F. NOLL (*Jour. Amer. Soc. Agron., 15 (1923), No. 3, pp. 87–99*).—This paper briefly summarizes data and observations from different sources on the effects of phosphate on early growth and maturity, and includes a few results secured on fertilizer plats at the Pennsylvania Experiment Station.

It is stated that fertilizer tests have quite generally shown that the use of phosphatic fertilizers induces earlier ripening of grain crops on soils deficient in phosphorus. Similar effects have been noted with cabbage and cotton. In the case of tomatoes the use of phosphates at the station has been accompanied by a much greater growth of stalk and larger total yield, but also by later ripening.

The effects of different phosphatic fertilizers seemed to vary with the availability of the phosphates. Applied at moderate rates, the soluble phosphates as a rule are said to have shown a more pronounced influence in hastening maturity than the same quantity of phosphoric acid in rock phosphate. Increasing the rates of application of phosphatic fertilizers beyond the needs of the crop has not been accompanied by further increases in earliness of maturity.

The composition of bitterns in pans in the Cape Province, G. J. R. KRIGE (*Jour. So. African Chem. Inst., 6 (1923), No. 1, pp. 8–10*).—Chemical analyses of samples of bitterns obtained from salt pans in the Cape Province are briefly reported and discussed, and are compared with bitterns from other countries, particularly the United States. It is noted that they have an appreciable potassium content.

New experiments on the liming of moor crops, A. RINDELL (*Mitt. Ver. Förd. Moorkult. Deut. Reiche, 40 (1922), Nos. 1, pp. 2–4; 2, pp. 20–22*).—A summary is presented of the results of several years of liming experiments with different crops on upland and lowland moor soils in Finland. The earlier experiments indicated that where upland moor soils had not been improved by the incorporation of sand or loam, lime had only a moderate effect, in spite of heavy fertilization with nitrogenous, phosphatic, and potassic fertilizers. Where the soil had been mixed with loam the action of lime was insignificant as far as oats, barley, and turnip crops were concerned, except on new soil where the loam contained toxic iron sulphids.

On lowland moor soils without incorporations of mineral soil, the action of lime was better on all crops, but was slighty less than where 400 cubic meters of loam per hectare (211 cu. yards per acre) had been added.

Later experiments with oats indicated an important action of lime on drained moor soils, which was strongly influenced by the incorporation of loam soil. The hay yield especially was markedly increased by liming when the soil had been improved by the incorporation of loam.

The effect of gypsum on Iowa soils, L. W. ERDMAN (*Soil Sci., 15 (1923), No. 2, pp. 137–155*).—Studies conducted at the Iowa State College to determine the chemical and bacterial effects of gypsum on Iowa soils and on crop growth

and protein content of crops on various Iowa soils under different conditions are reported.

The results from the chemical data and field work indicated that the soil type plays a prominent part in the effects of gypsum on soils. Gypsum in the amounts usually employed in agricultural practice rendered both the phosphorus and potassium contents of certain soils more soluble in a water extract, while on other soils little or no effect was observed. When gypsum was used in excessive quantities, however, there was a marked increase in the amount of water soluble potassium in all the soils studied.

The smaller applications of gypsum did not have any effect on ammonification and nitrification, while the larger amounts were slightly unfavorable to these processes. All of the gypsum treatments were unfavorable to nitrogen fixation as measured by the amount of nitrogen fixed in solution per gram of dextrose. The results on carbon dioxid production showed that gypsum did not hasten the decomposition of the soil organic matter, except perhaps in a highly basic soil.

In field experiments gypsum was favorable to clover and small grain in several instances. At the rate of 200 lbs. per acre it exerted a distinctly beneficial influence on the production of alfalfa hay.

Analyses of rain and drainage waters emphasized further the importance of the sulphur problem in agriculture. The amount of sulphur lost in the drainage was far greater than that added to the soil in rain water. These results are taken to indicate that even though soils may be supplied with sulphur at the present time, this sulphur is constantly being oxidized to the sulphate, in which form it is readily leached away in the drainage waters.

It is concluded that if any system of soil fertility is to be permanent a provision must be made for the addition of sulphur in some form to the soil. This may be accomplished economically through the use of barnyard manure, gypsum, or acid phosphate.

Mineral resources of the United States in 1921.—Preliminary summary, compiled by M. B. Clark (*U. S. Geol. Survey, Min. Resources U. S., Prelim. Summary, 1921, pp. IV+102A*).—Following an introductory statement by G. F. Loughlin, this preliminary summary contains, among other things, sections on gypsum, lime, marl, peat, phosphate rock, and potash.

A summary of the Swedish fertilizer industry (*Amer. Fert., 58 (1923), No. 9, pp. 25–31, figs. 9*).—Data are briefly presented on the production, consumption, export, and import of commercial fertilizers containing phosphoric acid, potash, and nitrogen in Sweden, particularly for the years 1920 and 1921. Data are also given on methods and equipment for manufacture, and important manufacturing plants are illustrated.

Commercial fertilizers, 1922, G. E. Colby et al. (*Calif. Dept. Agr. Spec. Pub. 35 (1923), pp. 36*).—This report contains general information regarding the regulation of fertilizers in the State of California, and presents guaranties and actual analyses of 253 samples of fertilizers and fertilizer materials collected for inspection in the State from July 1 to December 31, 1922. Of these samples 24 per cent were found to be deficient in one or more fertility components.

Commercial fertilizers, E. G. Proulx et al. (*Indiana Sta. Bul. 269 (1923). pp. 64, figs. 2*).—This bulletin contains guaranties and the results of actual analyses of 1,216 samples of fertilizers and fertilizer materials collected for inspection in Indiana during 1922. The standing maintained by different fertilizer manufacturers, improvements in Indiana fertilizer, and elimination of inferior nitrogen are also discussed. It is stated that a decided improvement has taken place in the quality of the nitrogen used.

AGRICULTURAL BOTANY.

Studies in plant respiration and photosynthesis, H. A. SPOEHR and J. M. MCGEE (*Carnegie Inst. Wash. Pub. 325 (1923), pp. IV+98, figs. 27*).—The experiments on photosynthesis which were begun at the Desert Laboratory in Tucson, Ariz., some eight years previously have yielded, among other things, the conclusion that prerequisite to an understanding of the nature of the energy transfer in photosynthesis was a more extensive knowledge of the metabolism of chlorophyllous organs. It became clear that, before attempting to follow the course of the synthesis of carbohydrate material in illuminated leaves, it was essential to know more about the conditions governing the equilibria and mutual transformations of the various groups of carbohydrates, quite independent of the photosynthetic process. In a previous publication (E. S. R., 44, p. 426) some of the more essential of these conditions were described. A further prerequisite to an understanding of the carbohydrate economy of chlorophyllous leaves is more precise information regarding the nature of the carbohydrate catabolism and the conditions governing this phenomenon.

In the present publication are described the results of experiments on the relation of the amino acid and carbohydrate content to the respiration of leaves. The information gained from these studies, as well as from those of a number of other workers in this field, helps to emphasize the fact that photosynthesis is an exceedingly complex process. This publication comprises the results of investigations carried out during 1919–1922.

If a close interdependence between photosynthesis and respiration actually exists, a better understanding of the nature of respiratory activity is an absolute prerequisite to further investigation of this relationship. The present study is in two main parts, one dealing with the carbohydrate and amino acid relation in the respiration of leaves, the other with the internal factor in photosynthesis. A considerable amount of data is presented as obtained from studies on *Helianthus annuus*, though data based on study of other plants are also considered.

The experiments on the relation between respiration and photosynthesis are being extended, especially with a view of determining the temperature coefficients under a variety of conditions. There is considerable evidence for believing that the photosynthetic process is of a dual nature or even more complex, involving the general principle of coupled reactions. That one of these, or one group of these, reactions is photochemical there seems to be little doubt. The nature of the other reaction (Willstätter's enzymatic reaction), or that associated with the respiratory activity, is still very obscure. In what manner these two sets of reactions complement each other or how they are coupled is one of the most vital points of the photosynthesis problem. In view of the importance and the insight which can be gained from the interpretation of temperature coefficients on the basis of recent physical chemical investigations, an extension of these determinations is deemed highly desirable and to offer another means of analyzing the phenomenon of photosynthesis.

Carbohydrate production by sun and shade leaves, M. G. STÅLFELT (*Meddel. Statens Skogsförsöksanst., No. 18 (1921), pp. 221–280, figs. 16*).—In case of *Acer platanoides* carbohydrate production in shaded leaves ranged much lower than did that of leaves in sunshine. Data are given also on removal or storage of carbohydrate and other conditions affecting the percentage.

Studies on *Pinus sylvestris* and *Picea excelsa* showed these conifers to be more sensitive than *A. platanoides* to factors disturbing assimilation, the intensity of which both these conifers augment with increase of illumination. Apparently the normal aerial carbon dioxid concentration is not a definitely

limiting factor for assimilation by these conifers, which appear to have relatively less chlorophyll in their assimilating organs than have the broad leafed trees.

The light intensity at which these conifers show a balanced condition between assimilation and respiration with normal carbon dioxid supply is apparently higher than in case of plants studied heretofore.

The adaptations of the plants tested as regards situations of light or shade are presented in some detail and discussed as to their practical bearings.

The grand period of growth of root hairs, R. E. JEFFS (*Okla. Acad. Sci. Proc.* [*Okla. Univ.*], *1922, II, pp. 53–56, figs. 6*).—A study of seedlings of pop corn and of radish shows that root hairs spring from the upper region of root elongation, and that the root continues to elongate for an average of 1.5 to 3 hours in the region in which new hairs are starting. The rate of elongation in the region of newly forming root hairs decreases rapidly. Root hairs show at first slow growth, gradually increasing up to the time when root elongation ceases, a definite relation appearing between the elongation of root and root hair. The initial growth rate of 5 root hairs from different roots was 6.5 μ per 15-minute interval. This increased to 16.1 μ at the end of the first hour and to 33.6 μ at the end of the third hour, after which there was no further root elongation in this region, though the root hairs grew at an average rate of 35 μ per 15-minute interval for the next 3 hours. As a root hair matures, its growth rate slows up very rapidly.

Growth and composition of orange trees in sand and soil cultures, H. S. REED and A. R. C. HAAS (*Jour. Agr. Research* [*U. S.*], *24* (*1923*), *No. 9, pp. 801–814, pls. 5*).—Orange trees were grown in soil and sand in pots or tanks to which culture solutions previously described by Hoagland (E. S. R., 44, p. 324) were supplied. Satisfactory growth was secured in both media where trees of approximately the same size were used. The results are said to indicate that the nutrition of young trees may be studied in a quantitative way under controlled conditions by the procedure described. The reaction of the nutrient solution used shifted from pH 5.2 to 5.9 when the solution was in contact with sand, and further toward the neutral point when in contact with sand containing citrus rootlets. The relative amounts of new growth in sand or soil cultures were considered quite similar if the ratio between total dry weight and dry weight of corresponding portions be estimated.

Analyses of trees showed a high calcium content and a high calcium ratio. The percentages of total phosphorus in leaves and shoots were approximately equal. The leaves and rootlets in their dry matter contained the greatest percentage of total ash and nitrogen. The ash from all parts of the tree contained large amounts of carbonate, although the rootlets contained less than that of other portions. The ash of all parts of the tree was found rich in potassium and relatively poor in sodium. The various parts of the tree likewise contained large amounts of calcium and relatively small amounts of magnesium, both constituents being fairly well distributed throughout the tree. The distribution of sulphate in the ash was quite uniform throughout the tree with the exception of the rootlets, which contained nearly three times as much as the other portions of the tree.

Influence of the substrate and its H-ion concentration on pectinase production, L. L. HARTER and J. L. WEIMER (*Jour. Agr. Research* [*U. S.*], *24* (*1923*), *No. 10, pp. 861–878*).—In a previous publication (E. S. R., 45, p. 749) the authors reported the production of pectinase by *Rhizopus tritici*. In later studies comparisons were made of the production of the enzym on a number

of media. It was found that the cell wall-dissolving enzym was produced on all the vegetable media except prune decoction, but not on the synthetic media with glucose as a source of carbon or on beef bouillon. If pectin was used alone as a source of carbon in Czapek's nutrient solution, an active enzym was produced. The production of this macerating principle when growing on Czapek's solution and sweet potato decoction was not influenced by adjusting these solutions to different pH values. The enzym was not produced in Czapek's solution at any H-ion concentration tested, while it was secreted in sweet potato decoction at all concentrations tried.

It is considered that the substrate influences the production of pectinase, but that the H-ion concentration does not.

The influence of salinity of water on the germination and growth of halophyte plants, G. Poma (*Acad. Roy. Belg., Bul. Cl. Sci., 5. ser., 8 (1922), No. 2, pp. 81–99, figs. 2*).—A relation holds in case of several halophytes studied between germinative capacity and osmotic pressure of the medium such that increase of osmotic pressure lengthens the period required for germination and lowers the germination percentage, capacity to germinate disappearing also at a certain definite osmotic pressure for each kind of seed.

As regards growth, an optimum osmotic pressure exists for each kind of plant, which is not identical with that for germination. Plants show a remarkable range of adaptability to osmotic pressures in the medium. Germinative power withstands osmotic pressures as high as 44 atmospheres. After several days in such a medium, transference to fresh water results in quick germination and vigorous growth.

The pseudo-antagonism of sodium and calcium in dilute solutions, H. S. Reed and A. R. C. Haas (*Jour. Agr. Research [U. S.], 24 (1923), No. 9, pp. 753–758, pl. 1*).—Rough lemon, grapefruit, and other citrus seedlings were grown in solutions containing varying proportions of sodium and calcium.

It was found that citrus seedlings grown in the absence of calcium soon showed injury to the root system. The tops, however, may not show the effect for some time after the injury to the roots has become severe. If the injury had not progressed to far, the addition of calcium to cultures in which the roots had become gelatinized induced the production of lateral rootlets, the lowermost of which definitely delimits the dead from the living portion of the root.

The varieties of citrus studied are said to possess a marked capacity for the absorption of calcium ions. In very dilute solutions the amounts present may be too far below the equilibrium point within the plant to avoid a condition of starvation. In such cases it is believed that the phenomenon is due to starvation rather than antagonism. It is held that the experiments with citrus seedlings have not demonstrated the existence of antagonism between sodium and calcium when the plants are grown in very dilute solutions.

Effect of different concentrations of manganese sulphate on the growth of plants in acid and neutral soils and the necessity of manganese as a plant nutrient, J. S. McHargue (*Jour. Agr. Research [U. S.], 24 (1923), No. 9, pp. 781–794, pls. 2*).—In continuation of studies on the rôle of manganese (E. S. R., 47, p. 820), the author gives the results of an investigation on the effect of increased concentrations of manganese sulphate on the growth of plants and on the necessity of manganese by plants.

Plants were grown in soils to which manganese sulphate was added in varying degrees and in water and quartz sand cultures which received culture solutions with and free from manganese. In the experiments with acid soil it was found that only small amounts of total manganese were soluble in

water. The applications of more manganese, in the form of sulphate, to the acid soil caused a decrease in the yields of the crops, whereas like quantities, when applied after the addition of calcium carbonate, caused an increase in the yields of plants.

The author believes that the occurrence of soluble salts of manganese in acid soils may be one of the causes of toxicity in such soils as exhibit toxic effects. An excess of manganese sulphate in a soil was found to render it sterile with respect to the growth of plants.

In the studies to determine whether or not manganese is essential for the normal growth of plants, it was found that leguminous plants are apparently more sensitive to the lack of manganese than are the nonlegumes. A very small amount of manganese was required for the normal growth of the different plants experimented with.

Seeds of radish, soy bean, cowpea, field pea, and corn did not contain enough manganese for the growth of the plant to maturity. It was found that seeds of some plants contained enough manganese to maintain a normal development for the first four to six weeks of their growth, and it was pointed out that experiments conducted for a shorter time in a manganese-free medium are not likely to give indications as to the necessity of this element for the growth of plants.

The lack of manganese is said to affect the production of dry matter in plants, indicating that it has some very important function in carbon assimilation. Carefully controlled experiments are believed to indicate that manganese has a function in the photosynthetic process and the formation of chlorophyll.

[Botanical studies of the Iowa Station] (*Iowa Sta. Rpt. 1922, pp. 32, 33*).—In a study of the seed coats and delayed germination in sweet clover there was recognized in the outer seed coat a light line that forms a continuous band which is impervious to water. It swells in hot water and becomes permeable, as is also the case when subjected to freezing. In scarifying seed, to become effective the light line must be broken.

It is claimed that the pollen of various cucurbits will in some cases stimulate the development of fruit without fertilization actually taking place. The pollen of the cucumber was found to germinate on the stigmas of the muskmelon, and it is thought probable that the character of the fruit may be influenced in this manner.

In a comparative study of the anatomy and cytology of Hubam and biennial sweet clovers no differences were observed in floral structure, chromosomes, or in the size of the cells. Differences in the rate of growth are attributed to the rapidity of cell division and not to cell enlargement.

The question regarding volutin in Azotobacter chroococcum, B. Issatschenko (*Centbl. Bakt. [etc.], 2. Abt., 57 (1922), No. 11–13, pp. 271, 272*).—The author cites publication of research of earlier date than the report by Schmidt (E. S. R., 43, p. 124), setting forth the same fact, the presence of volutin in *A. chroococcum.*

Methods of Gram staining, G. J. Hucker and H. J. Conn (*New York State Sta. Tech. Bul. 93 (1923), pp. 3–37*).—As a result of the investigation of 19 methods for staining bacteria, the authors have recommended no one particular technique. It is suggested that in order to determine the tendency of an organism with regard to the Gram stain, more than one staining procedure should be used, and that preparations of the culture be prepared at various stages of growth from 12 hours to several days in age.

FIELD CROPS.

[**Report of field crops work in Idaho, 1922**] (*Idaho Sta. Bul. 131 (1923), pp. 19–21, 47, 58–61, 65, 66, 67, 68*).—Varietal trials with winter and spring wheat and barley, oats, rye, corn, potatoes, field peas, alfalfa, clover, and miscellaneous legumes and grasses; breeding work with wheat, oats, barley, corn, peas, and orchard grass; and various cultural tests were made in continuation of earlier work (E. S. R., 45, p. 222).

Only a slight difference was noted in the yield of field peas as influenced by row or drill seeding with the same rate. A medium depth of seeding early in the season produced the best results, but at later dates little effect came from varying the depth. Early seeding averaged 6.5 bu. more than seeding 2 weeks later, and 13.6 bu. more than 4 weeks later. While fair yields of Hubam hay were obtained, the quality was inferior to that of other legumes of longer life period and equal productivity. Earlier results with biennial white sweet clover were substantiated, showing that a nurse crop, except peas, should not be used in the Palouse area, and that early seeding of 15 lbs. of scarified seed will produce profitable hay or pasture the first season. Early plantings of corn and sunflowers for silage have given heavier weights of dry matter, with an 8-in. spacing of sunflowers making the best yield. Shallow drilling, a 4-pk. rate, and September 1 date have given the best results with winter wheat at the High Altitude Substation.

[**Report of field crops work in Iowa, 1922**] (*Iowa Sta. Rpt. 1922, pp. 10–14*).—Investigations with field crops are reported on as heretofore (E. S. R., 47, p. 734).

Iowar oats seemed to exceed other varieties in yield but was not as good a nurse crop for clover or grass as Iowa 103 or Iowa 105. Iogren oats outyielded the parent variety, Green Russian, by an average of 7.6 bu. per acre. Rigid inspection of sources of pure seed of the pedigreed strains is maintained. The merits of Iodent corn (a Reid strain), Hubam clover, and Ames Amber sorghum are also set forth.

Cooperative tests of corn strains showed the highest yielders in northern Iowa to be strains of Silver King; in north-central Iowa, Iodent; south-central, a Black strain; and southern and south-central Iowa, Reid Yellow Dent strains. In northern Iowa, plats with 3.81 stalks per hill gave decidedly the best yields, in north-central Iowa 2.5, in south-central 2.87, and in southern Iowa 2.34. The continued planting of soy beans in corn, both for hogging down and silage, gave results similar to those of former years, the beans decreasing the yield of corn from about 3 to 7.5 bu. per acre, depending upon the thickness of planting and the variety used. The loss in corn is apparently more than made up by the beans, and the practice of growing these two crops in conjunction seems to be justified.

[**Report of field crops work in Nebraska**] (*Nebraska Sta. Rpt. 1922, pp. 24, 25, 26, 27, 28, 29*).—Early preparation of land and summer tillage showed to advantage over later preparation and continuous cropping, respectively, at North Platte (E. S. R., 47, p. 735). The heavier grain yields made after cultivated crops than after small grains are largely accounted for by the fact that the soil moisture is not so completely exhausted by the cultivated crop as it is by small grain. Kanred led the winter wheats, and the durums outyielded the common spring varieties, with Prelude first in the latter group. Early plantings gave good yields of potatoes on both irrigated and dry land, while almost total failures resulted from later seedings.

Experiments at Valentine included variety tests with sorghum and sorgo for forage, millet, rye, soy beans, and winter wheat; and seeding tests with corn, sorghum, and soy beans.

The yields of potatoes and sugar beets after alfalfa and manure at Scottsbluff, and the practicability of disking when sugar beet land can not be plowed early, have been noted before. Potatoes grown continuously were so scabby as to be unmarketable, while those grown in a 4-year rotation were affected much more than those in the 6-year rotation, which were generally quite free from scab. Corn following alfalfa has yielded about 25 bu. more grain per acre than where the land was not in alfalfa.

[Report of field crops work in North Carolina, 1921–22], C. B. WILLIAMS (*North Carolina Sta. Rpt. 1922, pp. 30–36*).—The progress of investigations with various field crops is reported on as heretofore (E. S. R., 47, p. 527). The merits of subterranean clover, narrow leaf vetch (*Vicia disperma*), and lespedeza (Tennessee No. 76) are pointed out, and improvement work at the station and substations with cotton, corn, soy beans, wheat, rye, and sorgo is reviewed. Unthinned cotton continued to yield highest, and in other plats with hills from 8 to 24 in. apart the thicker spacing yielded more than the thinner spacing.

In tobacco experiments at Oxford, in cooperation with the U. S. Department of Agriculture, dolomitic limestone increased the yield on all fertilizer plats without lowering the value of the leaf, and less leaf spot was met with on the limed ends of plats. Since previous experiments showed that ground calcite darkened the tobacco, dolomitic limestone with as much as 25 per cent of magnesium carbonate is recommended instead. From 36 to 40 lbs. of potash per acre is apparently enough for best results on the Durham sandy loam type of soil. In liming trials in conjunction with different magnesium and potassium materials, plats receiving dolomitic limestone had no sand-drown and both yield and quality of tobacco were improved, whereas sand-drown and leaf spot were serious on plats unlimed or receiving calcite, except where double manure salts and kainit were used. Where no lime was applied the yield of tobacco was from 35 to 40 per cent less than on the other two series. The most satisfactory 3-year rotation tested consists of tobacco; oats, followed by cowpeas or soy beans for hay or manure; and Abruzzi rye for grain.

[Field crops work on county experiment farms in Ohio in 1920 and 1921], C. W. MONTGOMERY ET AL. (*Ohio Sta. Bul. 361 (1922), pp. 341–343, 373–375, 388, 409–411, 436–438, 472, 473, 480–482, 496–498, 504, 505, 522–525, 540, 541, 562, 563, 565–568*).—Investigations with field crops on experiment farms in Miami, Paulding, Clermont, Hamilton, Washington, Trumbull, Mahoning, Belmont, and Madison Counties are reported on in continuation of earlier work (E. S. R., 45, p. 126). The experiments included varietal trials with corn for grain and silage, winter wheat, barley, oats, and soy beans for seed and hay, together with comparative yields of emmer, spring wheat, and cowpeas; seeding tests with winter wheat (E. S. R., 48, p. 135) and oats; shrinkage tests with silage corn; seed selection work with corn; fertilizer trials on pasture; and rotations.

[Field crops work on the Canadian experimental farms in 1922] (*Canada Expt. Farms, Rpts. Supts. 1922, Invermere (B. C.) Sta., pp. 6, 7, 15–20, 24–31, fig. 1; Agassiz (B. C.) Sta., pp. 19–24, 42–48; Sidney (B. C.) Sta., pp. 4–7, 23, 41–49, fig. 1; Summerland (B. C.) Sta., pp. 56–61, 68–84, fig. 1; Rosthern (Sask.) Sta., pp. 31, 32, 42–52; Scott (Sask.) Sta., pp. 20–51, 59–61, 67–81, figs. 4; Swift Current (Sask.) Sta., pp. 4–10, 15–19, figs. 2; Morden (Man.) Sta., pp. 12–18, 19, 20, 46–50, 57–66, fig. 1; Lacombe (Alta.) Sta., pp. 48–61, 72–77, 86–100, figs. 3; Lethbridge (Alta.) Sta., pp. 18–42, 55–68, figs. 3;*

Kapuskasing (Ont.) Sta., pp. 25–27, 32–36, 56–77; Charlottetown (P. E. I.) Sta., pp. 12–25, 40–49, figs. 3; Fredericton (N. B.) Sta., pp. 26–33, 48–68, fig. 1; Lennoxville (Que.) Sta., pp. 19, 20, 21, 22, 31–37).—Investigations reported on from Invermere, Agassiz, Sidney, and Summerland, B. C., by R. G. Newton, W. H. Hicks, E. M. Straight, and R. H. Helmer, respectively; Rosthern, Scott, and Swift Current, Sask., by W. A. Munro, M. S. Tinline, and J. G. Taggart, respectively; Morden, Man., by W. R. Leslie; Lacombe, Alta., by F. H. Reed; Lethbridge, Alta., by W. H. Fairfield; Kapuskasing, Ont., by S. Ballantyne; Charlottetown, P. E. I., by J. A. Clark; Fredericton, N. B., by C. F. Bailey; and Lennoxville, Que., by J. A McClary, embrace varietal trials of winter and spring wheat, oats, barley, winter and spring rye, millet, buckwheat, flax for seed and fiber, corn and sunflowers for silage, oats and peas for hay, field beans, peas, red clover, sweet clover, alfalfa, western rye grass, potatoes, mangels, swedes, rutabagas, field carrots, and sugar beets; rotations involving many of the crops named; comparison of silage crops, of nurse crops for sweet clover, and of annual crops and mixtures for hay; studies of pastures and the persistence of agricultural grasses; seeding tests with wheat, oats, barley, winter rye, sunflowers, flax, alfalfa, clover, timothy, potatoes, and silage crops; time of cutting tests with oats and sunflowers; fertilizer trials with corn, sunflowers, potatoes, and mangels; observations on the influence of windbreaks, spraying, and seed treatment on the yields of potatoes; breeding work with field beans, root crops, and potatoes; seed production trials with red clover, alsike, and timothy; and cost of production studies.

The cultural experiments concerned the effect on wheat and oats yields of depth of plowing, treatment of summer fallow and of stubble, and pastured v. cultivated summer fallow; effect of previous crops on seedings of grass and clover; methods of breaking western rye grass sod for winter wheat; value of barnyard manure applied in different cultural treatments for wheat, oats, and barley; green manures v. rotted barnyard manure for wheat; soil packing (E. S. R., 45, p. 824); cereals as substitutes for summer fallow; and miscellaneous cultural tests with corn, alfalfa, beans, sunflowers, and root crops. The greater part of the tests at Lethbridge were made both under irrigation and on dry land.

[Report of field crops work in Bengal], G. Evans et al. (*Bengal Dept. Agr. Rpt. 1921–22, pp. 3–5, 8–10, 31–38, 42, 43, 45, 47–49, 51–53, 56, 57, 65, 66, 68, 69, 84–86, 92–96, 101–103, 108–115*).—The progress of earlier experiments with field crops (E. S. R., 47, p. 32) is described.

According to G. P. Hector, the F_2 of hybrids between a highly colored autumn (early) rice and colorless winter (late) varieties segregated into two distinct periods as regards flowering date, approximating the flowering periods of the respective parents, with an interval of about three weeks during which no blooming took place. The ratio of late to early was about 3:1. Strong linkage apparently exists between color and earliness in the autumn rice and between absence of color and lateness in the winter rice studied.

Sunn hemp and barnyard manure have given the highest yields in fertilizer tests with tobacco by M. Carbery. The sunn hemp appeared to have a deleterious effect on broom rape (*Orobanche nicotiana*).

[Report of field crops work in Nigeria, 1922], O. T. Faulkner, T. Thornton, K. T. Rae, A. H. S. Vigo, and H. B. Waters (*Nigeria Agr. Dept. Ann. Bul., 1 (1922), pp. 51–76, 80–86, 91–97, 99–105, 108–115*).—The progress of earlier experiments (E. S. R., 49, p. 31) is reported, together with papers by T. Thornton entitled Cotton in the Ilorin Province and The Growing of Tobacco in the Ilorin Province.

Handbook of breeding of agricultural plants.—V, The breeding of colonial plants, C. FRUWIRTH (*Handbuch der Landwirtschaftlichen Pflanzenzüchtung.—V, Die Züchtung Kolonialer Gewächse. Berlin: Paul Parey, 1923, vol. 5, 2. ed., rev. and enl., pp. 272, figs. 50*).—A revised and enlarged edition of the volume noted earlier (E. S. R., 28, p. 736), covering the breeding of sugar cane, rice, sorghum, millet, sweet potatoes, cassava, citrus fruits, tea, coffee, cacao, cola, coconut and oil palms, olives, sesame, peanuts, castor bean, cotton, sisal, and other fibers, and cinchona and rubber plants.

[Culture tests of grasses and red clover in progress for 11 years], S. RHODIN (*K. Landtbr. Akad. Handl. och Tidskr., 62 (1923), No. 2, pp. 137–156*).—Comparative culture tests with reed fescue (*Festuca arundinacea*), meadow fescue (*F. pratensis*), brome grass (*Bromus inermis*), reed canary grass (*Phalaris arundinacea*), timothy, meadow foxtail (*Alopecurus pratensis*), and orchard grass were conducted from 1908 to 1914, inclusive. Timothy was compared with *Poa pratensis, P. trivialis,* and *P. serotina* from 1914 to 1916, inclusive. Several strains of timothy were tested for three years, and an experiment was made with red clover grown for seed. The weather conditions prevailing during the period are described, and the results secured are given in tabular form and discussed.

The average yields of different grasses and their comparative quality, as indicated by the results of the experiment, are summarized in the following table. The relative drought resistance is indicated in this table by the percentage relation of the crop of 1911 to the maximum yield of the particular grass during the experimental period.

Results of experiments with grasses conducted from 1909 to 1914, inclusive.

Grasses.	Average yield of hay per acre, 1909–1914.	Hay yield, second cutting, 1913.	Average dry matter production per acre.	Total nitrogen in dry matter, 1914.	Nitrogen, digestible.	Relative drought resistance, 1911.
	Tons.	*Tons.*	*Pounds.*	*Per cent.*	*Per cent.*	
Reed fescue	3.85	2.36	6,538	1.63	76.0	23
Awnless brome grass	3.79	1.57	6,189	1.09	75.2	43
Reed canary grass	3.73	2.14	6,309	1.42	71.1	45
Timothy	3.55	1.54	7,014	1.14	70.1	33
Meadow foxtail	3.38	1.13	4,889	1.29	62.1	36
Meadow fescue	3.22	1.00	5,525	1.25	74.4	24
Orchard grass	2.62	1.64	4,449	1.22	75.4	15

Timothy gave a larger average yield of hay, as well as of feed units, than that obtained from any one of the three species of Poa, and it also surpassed these in the production of hay during a very unfavorable season. Sowing timothy in rows 45 cm. (18 in.) apart gave better yields of seed and of straw than sowing the seed broadcast, and in a number of experiments commercial seed gave somewhat better results than the pedigreed strains with which it was compared. It appeared also from the results of an experiment that a seed crop of timothy succeeding a seed crop is likely to give lower returns in seed and straw than a seed crop succeeding a crop cut for hay.

Similar tests with meadow fescue indicated that generally an advantage is to be gained by growing different grasses in drills as compared with growing it broadcast, and that when oats is grown with meadow fescue as a nurse crop it is best to cut the oats before they ripen.

A comparison of drilled and broadcasted red clover grown for seed resulted in the best yield from the clover in drills 15 cm. apart, and the broadcasted

crop gave 521 lbs. of seed per acre as compared with 446 lbs. for the clover grown in drills 45 cm. apart. Cultivating the drilled crop in this test did not affect the quantity or the quality of the seed produced. In this experiment oats allowed to ripen was used as a nurse crop.

Congress of Cereals (*Cong. Prod. Colon. [Marseille], 1922, Compt. Rend. et Raps., Sect. Céréales, pp. 254*).—The proceedings of the Congress of Cereals held at Marseille during September, 1922, in conjunction with the Exposition Coloniale, are given in detail. Among the papers presented were The Selection of Durum Wheat, by L. Blaringhem (pp. 99–106); Intensive Wheat Production in Tunis, by Boeuf (pp. 107–128); Improvement of Cereals in Algeria (pp. 129–142) and The Impurities of Seed Grain (pp. 143–159), both by L. Ducellier; Preliminary Studies on the Hard Wheats of Morocco, by E. Miège (pp. 168–199); and Experimental Work with Rice at the Laboratory of Genetics and Seed Selection of the Scientific Institute of Indo-China (pp. 205–249).

How to seed legumes (*Idaho Sta. Bul. 131 (1923), p. 68*).—Extensive experiments at the Sandpoint Substation with red and alsike clover, sweet clover, alfalfa, and timothy recommend seeding on fall plowed land, giving the soil as good spring preparation as for a grain crop. From 8 to 12 lbs. per acre of inoculated seed of red clover, sweet clover, or alfalfa and 6 to 8 lbs. of alsike or timothy should be broadcasted, and the seeding followed with a light drag and the drag by some sort of packer. Success has been attained on early and late spring, summer, and early fall seedings. In late summer and early fall the clover has been sown after light rains.

Chemical composition of Hubam (*Iowa Sta. Rpt. 1922, pp. 35, 36*).—Hubam clover has been found to contain 3.85 per cent of nitrogen in the leaves and 1.5 per cent of nitrogen in the stems when in full bloom. Hubam clover is said to have an advantage over biennial white clover and medium red clover in the amount of nitrogen which it returns to the soil.

A classification and detailed description of the oats of Australia, A. E. V. Richardson et al. (*Aust. Inst. Sci. and Indus. Bul. 23 (1922), pp. 31, pls. 5*).—The third publication of this series (E. S. R., 48, p. 437) classifies and describes 25 of the more important varieties of oats grown in the Commonwealth. An account of the structure of the oats plant is included.

Seed potatoes and how to produce them, W. Stuart (*U. S. Dept. Agr., Farmers' Bul 1332 (1923), pp. II+18, figs. 7*).—This is a revision of Farmers' Bulletin 533 (E. S. R., 29, p. 230), with the statistics of production brought up to date.

Potato investigations (*Idaho Sta. Bul. 131 (1923), pp. 60, 61, 67, 68*).—Experiments with the Idaho Rural potato at the Aberdeen Substation indicated that 8-oz. whole seed produced more potatoes and stronger vines but fewer marketable tubers than either the halved or quartered. The 4-oz. whole potato produced more marketable tubers than the 8-oz. whole potato, but not as many as the halved 4-oz. seed piece. It seems best to cut the potatoes, but a 2-oz. seed piece is as small as should be planted. Hills 16 to 20 in. apart made the highest acre yield and the most marketable tubers on very rich land, and 24 in. on poorer land. From 8 to 12 in. planting is suggested for seed stock.

Studies at the Sandpoint Substation included tests of varieties and certified seed and cultural trials. Row plantings with seed 12 to 14 in. apart made the highest yield, but checking 3 by 3 ft. gave the most marketable tubers.

Blooming and harvest time of winter rye in Germany, H. Schreffer (*Arb. Deut. Landw. Gesell., No. 321 (1922), pp. 26, pls. 3*).—Based on extensive observations, the approximate blooming and ripening periods for winter rye

in Germany and adjacent regions are indicated on outline maps, and the relative influence of environmental factors, including soil, climate, latitude, altitude, topography, and distance from the ocean, on the blooming and ripening of winter rye is discussed. The phenological autumn is commented upon briefly in connection with the ripening periods of the buckeye (*Aesculus hippocastanum*), as indicated on a regional map.

Annual review [of the sugar industry] (*La. Planter, 70 (1923), No. 22, pp. 436–520, pls. 2, figs. 56*).—A comprehensive review of the cane and beet sugar industry of the world, with statistics of production and consumption and lists of sugar factories in sugar countries with capacities. Articles of interest to the agronomist include Origin and Development of the Sugar Industry of Louisiana, by W. C. Stubbs (pp. 438–441); The Unit Method of Estimating the Value of Commercial Fertilizer, by W. R. Dodson (p. 443); Recent Work on Sugar Cane at the Agricultural Experiment Station of Cuba, by M. Calvino (pp. 448–451); Mosaic and Other Cane Diseases and Pests in Cuba, by S. C. Bruner (pp. 452–455); Sugar Operations in India, 1921–22 (pp. 456, 457); Sugar in Australia, by T. D. Chataway (pp. 458–461); Sugar Production in Mexico, by E. Vinageras (pp. 461–463); Some Notes on the Culture of Sugar in Guadeloupe, by C. T. Allder (p. 463); and The Most Important Problems of Sugar Beet Agriculture in the United States, by F. Saunders (pp. 483–486).

Results of tobacco experimental work in Pennsylvania from 1912 to 1922, O. Olson (*Pennsylvania Sta. Bul. 179 (1923), pp. 28, figs. 25*).—Investigations with tobacco reported on for the period indicated included fertilizer tests in Lancaster, York, and Clinton Counties; comparisons of varieties and Seedleaf and Havana seed strains; burn tests; trials of steam sterilization, fumigation, fertilizers, and different rates of seeding on tobacco seed beds; determinations of the best planting distances and topping heights; influence of time of topping upon distances between leaves on stalks; effects of suckering on yield of cured leaf; production of tobacco with high and with low nicotin contents; control of root rot by resistant strains; curing with artificial heat to prevent pole burn; and redrying tobacco to control black rot. The experiments assembled in this bulletin were in cooperation with the U. S. Department of Agriculture and the Tobacco Growers Associations of Lancaster, York, Clinton, and Lycoming Counties, Pa., and have been extensively noted from other sources (E. S. R., 28, p. 138; 31, p. 437; 34, p. 141; 35, pp. 532, 533, 534; 43, pp. 533, 534; 46, p. 837; 47, pp. 435, 455). Machines for cleaning seed, smoking cigars, and drying tobacco are illustrated and described briefly.

Soil and climatic needs of the wheat crop, F. E. Bear (*Ohio Sta. Mo. Bul., 8 (1923), No. 7–8, pp. 119–123*).—Yield and meteorological data secured at the station indicate that in determining the acre yields of winter wheat, climatic factors are of primary importance, particularly during the months of October, January, March, and June. A dry October, a warm dry January, a cold wet March, and a wet June seem to favor high yields. Apparently, the root systems are better established in the autumn, the temperature is maintained above the critical point in the coldest month of the year, there is a sudden break between winter and spring, and the lack of water is not a limiting factor while the heads are being filled. On the other hand, fertilizers appear able to modify the influence of climatic factors so that the plant in some way is protected against drought, extremely cold weather, and heaving. Since the climatic factors seem to be more favorable for winter wheat in Ohio, Illinois, Pennsylvania, Michigan, and Indiana than in the other important winter wheat producing States, there seems to be a greater opportunity to raise the yields of wheat by improved soil practices in the States named.

Effect on wheat yields of variations in soil moisture during and after the critical period, G. Azzi (*Coltivatore, 68 (1922), No. 28, pp. 308–312*).—Further experiments (E. S. R., 48, p. 233) with Luigia Strampelli and Cervaro wheats substantiated the existence of the critical period as regards moisture supply during spike formation.

Observations on wheat plants in pots receiving water at different intervals gave indications that the critical period is the 15 days prior to spike formation. If less than the minimum requirement of water is available at this time, reduced yields will follow regardless of subsequent favorable conditions, whereas with ample moisture during the specified period good yields will follow, in spite of later less favorable conditions. If the soil remains dry during the critical period, applications of water made after the beginning of spike formation may cause a resumption of growth, but are considered useless so far as grain production is concerned. On the other hand, if the wheat has had enough moisture during the critical period, it can utilize irrigation water until an advanced stage of maturity.

Fertilizing the wheat crop in Ohio, C. E. Thorne (*Ohio Sta. Mo. Bul., 8 (1923), No. 7–8, pp. 124–128*).—Further consideration of fertilizer experiments (E. S. R., 47, p. 828) with wheat on county experiment farms led the author to conclude that the average Ohio farmer should depend upon the systematic growing of clover and the saving and use of manure for the nitrogen and for most of the potassium required for the production of corn, oats, and wheat. Phosphorus should be purchased and used much more liberally than has hitherto been the general practice.

Better wheat for Ohio farms, L. E. Thatcher (*Ohio Sta. Mo. Bul., 8 (1923), No. 7–8, pp. 110–116, fig. 1*).—The need of better wheat varieties in Ohio is pointed out, and the characteristics are given of Trumbull and Fulhio, pure line selections from Fultz; Portage and Ohio 9920, from Poole; and Gladden, selected from Gypsy. The agronomic qualities of the pure line selections and the parent varieties are compared.

Cultivation of the true yams in the Gulf region, R. A. Young (*U. S. Dept. Agr. Bul. 1167 (1923), pp. 16, pls. 10*).—The growing of the greater yam (*Dioscorea alata*) is considered as a potential crop industry in some of the South Atlantic and Gulf States. The plant and its varieties are described, introductions into the United States are indicated, explicit directions are given for growing and handling the crop, and several methods of preparing yams for the table are outlined. The other principal species of yams regularly cultivated in the West Indies and discussed briefly include the yellow Guinea yam (*D. cayenensis*), the lesser yam (*D. esculenta*), the acom (*D. latifolia*), the white Guinea yam (*D. rotundata*), and the yampi (*D. trifida*).

Weed control through spraying, A. Åslander (*Landtmannen, 6 (1923), No. 19, pp. 319–321, fig. 1*).—In reviewing a recent recent Norwegian book by Korsmo on weed eradication, the use of iron sulphate and sulphuric acid spray solutions in combating weeds is discussed and the results secured in different tests are reported.

A series of tests conducted in Sweden in 1921 and in 1922 showed that a 3.5 to 4 per cent solution of sulphuric acid was effective in destroying weeds in fields of oats, barley, and mixed grain. The increase in yields of mixed grain on the treated fields ranged from 630 to 678 kg. per hectare (561 to 603 lbs. per acre) for oats, from 414 to 882 kg. for barley, and from 590 to 595 kg. for the mixed grain. The yields of grain on the sprayed fields were increased generally, but the yields of straw, particularly those of barley, were decreased in some instances. Applications of a 3 per cent solution of sul-

phuric acid and of a 15 per cent solution of iron sulphate did not give quite so good results as those obtained with a 3.5 to 4 per cent solution of sulphuric acid. *Chenopodium album* and *Fumaria officinalis*, owing to the protection afforded them by glandular hairs, were not affected by the treatment.

In spraying experiments carried on in different parts of Norway with 3.5 to 4 per cent solutions of potassium nitrate, applied on fields of oats, barley, and spring and winter wheat, consistent increases in the yield of grain were obtained. A decrease in the yield of straw resulted only in the case of barley.

HORTICULTURE.

Light in relation to the growth and chemical composition of some horticultural plants, G. T. NIGHTINGALE (*Amer. Soc. Hort. Sci. Proc., 19 (1922), pp. 18–29*).—The results of chemical analyses conducted in connection with growth observations upon greenhouse-grown tomato, salvia, buckwheat, radish, and soy bean plants exposed to different day lengths and in the case of tomato and salvia to different nutrient conditions in respect to nitrogen lead the author to conclude that it is the proportion of carbohydrates to insoluble nitrogen and not the total amounts of these materials which determines the type of growth. The presence of nitrates, as such, in a plant did not, apparently, materially affect the type of growth. It is believed that in the case of the tomato, at least within the limits of a 6-hour day, light may effect the rate of but is not a limiting factor in the synthesis of nitrates to insoluble forms of nitrogen provided there is a source of carbohydrates within the plant.

Nitrates and probably some other forms of soluble nitrogen do not directly affect growth, but are stored until proper conditions obtain for synthesis to other forms of nitrogen. Conditions resulting in a decrease of insoluble nitrogen and a still greater proportional decrease in carbohydrates resulted in a strongly vegetative and unfruitful plant containing a relatively high proportion of insoluble nitrogen to carbohydrates. Conditions favoring formation of an abundance of insoluble nitrogen and simultaneously an abundance of carbohydrates resulted in a vigorously vegetative and fruitful plant. Condition resulting in a decrease of available soluble nitrogen without simultaneously decreasing the carbohydrate supply resulted in a very high proportion of carbohydrates to insoluble nitrogen and produced a weakly vegetative and unfruitful plant.

Buckwheat, soy beans, radish, and salvia were limited in the synthesis of nitrates to insoluble forms of nitrogen by a 7-hour day, even though there was present an available supply of carbohydrates. A large decrease of carbohydrates in tomato plants, already very high in these materials, was apparently coupled with decomposition of insoluble nitrogen when this decrease was brought about by reduction in time of exposure of plants to light. Also new growth was produced even though there was no external supply of nitrates available to the plant. In the tomato insoluble nitrogen was not decomposed to nitrates.

[Horticultural investigations at the Idaho Station] (*Idaho Sta. Bul. 131 (1923), pp. 45–47, 48, 49*).—Observations on apple seedlings of known parentage revealed none which has produced fruit greatly superior to both parents when all characters are considered. Of 498 trees produced as a result of reciprocal crosses between Jonathan and Ben Davis, 29 yield fruits as good as and 16 superior to Ben Davis and one as good as or better than Jonathan. That quality in parents is essential to quality in seedlings was demonstrated by the fact that only 2 promising seedlings have been found in over 800 trees having Ben Davis as one parent.

Selection work with early maturing varieties of tomatoes has resulted in the isolation of high yielding strains.

Studies in seed production have indicated that in the case of biennial vegetables satisfactory wintering may be obtained by covering plants in situ in the field rather than storing in cellars. Late sown biennial plants were successfully wintered when grown in cold frames later covered with ashes.

A test of small fruit varieties showed the Cuthbert raspberry and the Eldorado blackberry to be of superior merit.

[**Horticultural investigations at the Iowa Station**] (*Iowa Sta. Rpt. 1922, pp. 44, 45, 46, 47, 48, 59–61*).—This is the usual annual report (E. S. R., 47, p. 741), presenting brief progress notes on miscellaneous investigations.

Propagation studies with apples revealed one variety which roots rather freely without artificial aid and which may for this reason prove valuable as a stock. Studies of the sap of hardy apple varieties indicated the possibility of ascertaining the degree of hardiness by color determinations. The wrapping of stored apples with oiled papers reduced scald injury. Observations on the amount of spot developing on Jonathan apples picked at weekly intervals indicated the desirability of early harvesting of fruits designed for storage. Aeration by electric-driven fans prevented soft scald on Jonathan, but was not entirely successful in the case of Grimes apples which were not fully mature at time of harvest. In contrast to the Jonathan, the Grimes kept better when picked nearly mature. Both Grimes and Jonathan reach maturity early and can not be profitably held in storage later than January 1. Fertilizing studies with apple trees at Williamsburg and Charles City indicated that fertilizers are of little value on heavy, fertile soils. On a poorer soil type at Council Bluffs nitrate of soda increased the vigor of trees.

The topping of Stowell Evergreen sweet corn plants failed to exert any influence on the time of maturity of the seed ears.

A study of apple seedlings of known parentage showed that certain parental combinations are liable to yield promising seedlings, while others are of no value. A list is given of combinations which have resulted in seedlings worthy of naming. Northwestern Greening trees grown in the experimental orchard at Council Bluffs under four systems of soil management, namely, clover sod, cover crops, clean culture, and blue-grass sod, yielded during the period 1912–1921 average annual yields of 473.4, 456.4, 425.3, and 298.5 bu. per acre for the respective treatments. The trees in blue grass lacked sufficient vigor to produce terminal growth capable of forming lateral fruit buds, and what fruit buds were produced were mostly formed in years of nonfruiting. Fertilizer applications to blue grass sod grown trees resulted in an increased yield. Northwestern Greening trees exposed to ample sunlight greatly outyielded trees within the orchard.

[**Report on horticultural investigations at Cheshunt**] (*Expt. and Research Sta., Cheshunt, Herts., Ann. Rpt., 8 (1922), pp. 4–33, 57–66, figs. 7*).—This is for the most part a progress report upon long-continued experiments (E. S. R., 47, p. 637).

The mulching experiment with tomatoes begun in 1920 was completed during the year. The average number of tons of fruit per acre for the 3-year period were 40.4 for no mulch, 41.3 for dung mulch, and 41.2 for straw mulch, leading to the conclusion that, under the prevailing conditions, no significant yield increases were obtained from the use of mulches. It is conceded, however, that mulching is of benefit in assisting in the retention of soil moisture.

Further work in the soil aeration experiment with tomatoes failed to yield any conclusive results, the plat through which air was forcibly circulated yielding only 6 per cent more fruit than the control plat. Unlike the previous

year, the plants on the aerated sections proved no more resistant to disease than did those of the untreated areas.

Fertilizer tests in which Comet and Kondine Red tomato plants were supplied with different forms and amounts of nutrients showed the highest yield of Comet tomatoes on complete fertilizer plats and the highest yield of Kondine Red fruits on the complete fertilizer plus manure plat. The Kondine Red was much more productive than the Comet. Cucumbers growing in beds the subsoil of which was sterilized with steam outyielded control areas by 35 per cent, while plants in beds the subsoil of which was covered with a thin layer of concrete did not yield significantly better than the control. On the supposition that cucumber plants bearing seed fruits are more resistant to anthracnose and red spider than are normal plants, certain plants bearing one fertilized fruit along with the regular crop were compared with plants bearing all unfertilized fruits. The bearing of fertilized fruit reduced yield and apparently had no favorable influence on disease or insect resistance. Soil sterilization investigations, continued in 1922, yielded contradictory results. However, in most cases treatment with steam, formaldehyde, carbolic acid, or hot water gave increased yields.

Investigations upon the fertilizing effects of carbon dioxid, commenced during the year, and reported by L. B. Timmis, dealt entirely with the development of methods of technique to be employed in supplying the gas to greenhouses.

Further studies on the inheritance of "rogue" type in garden peas (Pisum sativum), W. Brotherton, jr. (*Jour. Agr. Research [U. S.], 24 (1923), No. 10, pp. 815–852, pls. 8, figs. 3*).—As a further contribution to the subject (E. S. R., 46, p. 37), the author presents data upon the first three filial generations of intervarietal crosses of rogue and type plants with plants of a variety which is apparently stable. Abandoning the hypothesis that the nonappearance of Gradus segregates in the F_2 generation of the cross Gradus×Gradus rogue is due, as suggested by Bateson and Pellew (E. S. R., 47, p. 29), to somatic segregation of the type and rogue elements in the F_1 hybrid, the author advances the concept of mass somatic mutation to account for the anomalous hereditary behavior of rogues, and outlines in detail a theoretical segregation and recombination of factors in different generations resulting from crosses between pure and rogue type Gradus plants and between Gradus types pure and rogue and the Mummy, an English pea free from rogue-producing tendencies.

The author believes that Gradus rogue peas owe their origin to the mutation of a single factor x, determiner for the mean ratio between length and width of stipule in pure Gradus, to X, the factor determiner for the corresponding ratio in Gradus rogues. Primary rogues are, therefore, heterozygous in respect to this factor, possessing the genetic formula xX, a combination which is assumed to be unstable, having a tendency to become XX through recurrent mutation, thus accounting for the dominance of rogue type in the F_2 generation of Gradus×Gradus rogue crosses. A microscopical examination of Gradus and Gradus rogue pollen showed no morphological evidence of defective pollen grains, both types having approximately 100 per cent perfect pollen.

Art of grafting in India, G. B. Set (*Calcutta: Ivy Nursery Gardens, 1920, pp. [4]+74, figs. 20*).—A small pocket manual presenting practical information.

Effect of shading and ringing upon the chemical composition of apple and peach trees, H. R. Kraybill (*New Hampshire Sta. Tech. Bul. 23 (1923) pp. 3–27*).—This further contribution (E. S. R., 47, p. 436) to comprehensive studies in fruit bud formation in horticultural plants presents and discusses the results of analyses of composite samples of recent growth taken from apple

and peach trees of contrasting fruit bud performance induced in part by artificial means, namely, shading and ringing.

It was found that the last two seasons' wood of Oldenburg apple trees which previous to shading in 1917 and 1918 were very fruitful and thereafter of almost negative productivity was higher in moisture and total nitrogen and lower in dry matter, free reducing sugars, and starch than that from comparable unshaded trees. Analyses of 1-year growth of Elberta and Carman peach trees shaded in 1919 and 1920 and likewise suffering therefrom a reduction in fruit bud formation showed similar changes to those occurring in the apple. Analyses of samples taken in June, 1919, and July, 1920, of the last 2 years' growth of two alternate bearing Yellow Transparent apple trees fruiting in different years showed the fruiting trees slightly higher in moisture and total nitrogen and lower in starch. In samples taken in April, 1920, the starch content as well as the moisture and total nitrogen was slightly higher in the fruiting than in the nonfruiting tree.

In the case of 8-year-old McIntosh trees, in which ringing on June 1 greatly increased fruit bud formation, analyses of samples of the last 2 years' growth taken on June 26, July 5, and July 8 showed that the wood of ringed trees was lower in moisture, slightly lower, if any, in total nitrogen, slightly higher in free reducing sugars and sucrose, and much higher in starch. Samples taken September 4 were lower in moisture, slightly higher in total and insoluble nitrogen, and higher in starch and acid hydrolyzable material in the ringed than in the unringed trees. Analyses of samples taken on March 31 of the succeeding year showed the ringed trees to be higher in moisture and total nitrogen and practically the same in starch as the unringed trees.

In general conclusion, the author points out that the action of shading in reducing fruit bud formation is probably due to either the reduction of carbon assimilation, the increase of nitrogen intake, or perhaps to a combination of both. The stimulation of fruit bud formation by ringing is deemed to be due largely to the prevention of translocation of the carbohydrates to the roots rather than to the inhibiting of the intake of nitrogen. It is believed that the effects of shading and of ringing on fruit bud formation are in accord with the relations of carbohydrates and nitrogen to growth and reproduction, as outlined by Kraus and the present author in a previously noted paper (E. S. R., 40, p. 40).

How and when to prune apple trees, J. D. LUCKETT (*New York State Sta. Bul. 500, pop. ed. (1923), pp. 7, figs. 3*).—This is a popular edition of the previously noted bulletin (E. S. R., 49, p. 339).

The calyx spray for apples, pears, and quinces, W. E. BRITTON and G. P. CLINTON (*Connecticut State Sta. Bul. Immed. Inform. 24 (1923), p. 1*).—A formula for the preparation of the calyx spray is presented in connection with a brief discussion of its function in controlling insect and fungus pests.

The cane fruit industry in Oregon, H. HARTMAN (*Oregon Sta. Circ. 48 (1923), pp. 3–28, figs. 10*).—A compilation of general information relative to the establishment and care of red and black raspberry, loganberry, and blackberry plantations. A fertilizer test with nitrate of soda on red raspberries is reported. Notes concerning the handling and drying of fruit are added.

Pruning citrus trees in the Southwest, A. D. SHAMEL, C. S. POMEROY, and R. E. CARYL (*U. S. Dept. Agr., Farmers' Bul. 1333 (1923), pp. II+32, figs. 24*).—A profusely illustrated paper in which the principles and practices of citrus pruning are discussed in a comprehensive manner. It is emphasized that light pruning, comprising the removal of suckers and decadent branches, has an almost negligible effect on productivity, whereas severe pruning of healthy, bearing trees usually reduces yield in proportion to the severity of the opera-

tion. Inherently productive trees are said to require little pruning in order to keep them in a profitable, productive condition.

Coloring Satsuma oranges in Alabama, R. C. WRIGHT (*U. S. Dept. Agr. Bul. 1159 (1923), pp. 23, figs. 3*).—Investigations begun in the fall of 1919 showed that the yellowing of the Satsuma orange, a fruit which in Alabama frequently reaches satisfactory maturity while externally green, may be greatly accelerated by placing the fruit in storage chambers to which is supplied the exhaust gas driven off by a gasoline engine or by the incomplete combustion of kerosene in a stove. In properly constructed plants, the operation and plans of which are thoroughly discussed in the text, coloring the Satsuma orange may be completed in four days provided the fruit is sufficiently mature and carries at least 5 per cent of yellow color when placed in the processing chambers. It is emphasized that all oranges for coloring must pass the Federal requirements, which specify that the juice of oranges entering interstate commerce shall contain not less than 8 parts of soluble solids to each part of acid calculated as citric acid without water of crystallization. It is pointed out in the paper that the great advantage of the coloring operation lies in the ability to place the fruit on the market during the interim between the late California and the early Florida crops. Furthermore, in many instances, fruit ripened to full color on the trees loses flavor and tends to become insipid. A popular account of the investigation has been previously noted (E. S. R., 46, p. 339).

The coconut palm, H. C. SAMPSON (*London: John Bale, Sons & Danielsson, Ltd., 1923, pp. XIV+262, pls. 44, figs. 4*).—This is a general discussion dealing with the science and practice of coconut cultivation.

The official 1922 yearbook of the Society of American Florists and Ornamental Horticulturists (*New York: A. T. De La Mare Co., Inc., 1923, pp. XXIV+342+XXV–LII, figs. 50*).—This yearbook includes summarized proceedings of the thirty-eighth annual convention and the fifth national flower show. It is designed to serve as a standard guide, trade directory, and reference book for 1923.

The American rose annual, 1923, edited by J. H. MCFARLAND (*Harrisburg, Pa.: Amer. Rose Soc., 1923, pp. 192, pls. 19, figs. 9*).—This volume, prepared like those of previous years (E. S. R., 47, p. 344), constitutes a review of activities in the rose world during the year 1922. Special attention is devoted to new introductions, and valuable suggestions are made relative to selection of varieties, culture, and care.

FORESTRY.

Some results at Avondale Forestry Station, A. C. FORBES (*Ireland Dept. Agr. and Tech. Instr. Jour., 23 (1923), No. 1, pp. 3–11, pls. 2*).—This is a progress report (E. S. R., 30, p. 45) upon forest planting experiments begun in 1906 to test the value of a large number of indigenous and exotic species and to determine what species are of value as nurse crops for rare and slow-growing trees.

Frequently occurring late spring frosts have been found to be the chief limiting factor to successful tree development in many of the species. The silver fir, the Douglas fir, and the ash were particularly severely injured. Species rarely or never injured include *Abies grandis, A. nordmanniana,* various pines, birch, alder, poplar, sycamore, and hornbeam.

The larch and the common spruce were found to be too rapid growing to be of value as nurse trees for a majority of broad-leaved species. Scotch pine

was also unsatisfactory, being either too fast or too slow growing for the majority of species. Notes on the behavior of many species of broad-leaved trees indicated that, in general, species from America were unsatisfactory, apparently being unable to thrive during the cool summers. Coniferous trees have, in general, given much more satisfaction at Avondale than the broad-leaved trees. Of several species of silver fir tested, *A. grandis* made an excellent showing, averaging from 30 to 40 ft. in height. *A. pectinata*, many of the trees of which have succumbed, is described as an absolute failure. The Sitka and the common European spruce were the only spruce species to prove satisfactory. The Sitka, after release from severe suppression by nurse crops of larch, showed an extraordinary recuperative ability. *Pinus insignis* (*radiata*) proved a rapid-growing species. The white or Weymouth pine planted by itself attained a height of from 20 to 25 ft. Of the many species of larches tested, only two, the Japanese and the common European, proved satisfactory.

The author concludes that the larch and spruce are satisfactory nurse crops only for the fast-growing species. It is believed that the use of fairly large, well-rooted nursery trees planted 4 to 6 ft. apart is the best and most economical practice under environments such as those obtaining in the experiment. A table is appended showing the increase in height during the 10-year period 1912–1922 for the various species.

Cocobolo, S. J. RECORD and G. A. GARRATT (*Yale Univ. School Forestry Bul. 8 (1923), pp. 42, pls. 8, figs. 11*).—Cocobolo, a valuable timber produced in Central America and southwestern Mexico, chiefly on the west coast, is the product of at least three species of leguminous trees, namely, *Dalbergia retusa*, *D. hypoleuca*, and *D. granadillo*. The trees usually grow as an understory in hardwood forests and are widely scattered and difficult to obtain in any quantity. The wood, on account of its hardness, beauty, ease of working, and resistance to moisture effects, is extensively used for manufacturing handles of knives, brushes, small tools, etc. The dust arising in working cocobolo wood is toxic to some people, but no injury is ever caused from handling the solid wood. No satisfactory substitute is known for cocobolo, although the American hickory is sometimes dyed red in imitation of the genuine material.

The relation of temperature to seed production in the Scotch pine forests of northern Norway, E. EIDE (*Meddel. Norske Skogforsøksv., No. 3 (1923), pp. 39–87, figs. 5*).—In order to ascertain the effect of summer temperatures on quality, seed extracted from cones gathered in the winter of 1921 in the vicinity of temperature stations distributed throughout a wide area in northern Norway were tested for viability in Jakobsen electric-heated germinators (86° F.).

The results, presented in tabular and graphical form, show no well-defined correlation between length, volume, weight, or ease of opening the cones and viability. Volume and weight of seeds, on the other hand, were found to be in closer agreement with viability, but were affected by dead and empty seeds. Records showed that 28 of the 36 lots tested ripened during an average summer temperature of more than 50.9° F., a degree believed by Hagem to be the minimum of successful seed production. Five of the lots matured in a summer temperature of more than 53°. After allowing for empty seeds, a closer agreement was found between viability and the ripening temperature.

The author believes that not one but several factors, namely, (1) soil conditions, (2) climatic relations, and (3) periodicity in sex of flowers, are responsible for the fluctuations in the viability of seed. At rare intervals, for example, in east Finmark in 1920, the male and female flowers did not reach

maturity in the same season. The theory that viability of seed lessens with increased elevation was not borne out in the tests, local factors apparently causing many exceptions to the rule. Delayed germination observed in certain seeds which remained dormant for over 200 days despite the ideal growing conditions in the germinators was believed by the author to be due to incomplete maturity, a condition caused perhaps by variations in light and thermal environment in the forest. The author points out that the average summer temperature of 50.9°, proposed by Hagem as the minimum for successful regeneration, is attained in northern Norway at rare intervals. That temperature is not the only limiting factor is further emphasized by the fact that poor regeneration often occurs in more southerly forests. It is concluded that the sparse regeneration in the northern woods is due mostly to poor soil conditions and not to low temperatures prevailing throughout the summer season.

Forestry in Norway, W. Opsahl (*World Agr., 3 (1923), No. 2, pp. 250, 251, figs. 2*).—Statistical information regarding the forestry resources of Norway is presented.

Progress report of forest research work in India for the year 1921–22 (*Forest Research Inst., Dehra Dun, Prog. Rpt., 1921–22, pp. [3]+102, pls. 7*).—A general report on experimental activities throughout India during the year ended March 31, 1922 (E. S. R., 48, p. 739).

Data are presented in tabular form on germination tests at Dehra Dun with a large number of forest species. Transplanting experiments with *Cinnamomum camphora* showed 48 per cent success for entire transplants unweeded and 80 per cent for the same weeded, and 94 per cent for root and shoot cuttings unweeded and 100 per cent for the same weeded. Nitrogen-fixing bacteria were found in nodules occurring on the roots of Casuarina from Bihar and Orissa. Notes are given on the time required for the seed of various Madras species to germinate and the length of the period through which seeds retain their power of germination under ordinary conditions. In addition to financial reports, a list of available bulletins is appended.

The forests of India, E. P. Stebbing (*London: John Lane, the Bodley Head Ltd., 1922, vol. 1, pp. XV+548, pls. 28; 1923, vol. 2, pp. XII+633, pls. 37*).—A detailed history, presented in narrative form, of the British forest administration in the various provinces of India.

Chinese economic trees, W. Y. Chun (*Shanghai: Commercial Press, Ltd., [1921], pp. XXVII+309+IX, pl. 1, figs. 99*).—A manual of the more important forest species of China, designed to serve as a ready aid for identification and also as a text for use in class work.

DISEASES OF PLANTS.

[Report of Idaho Station work on] plant pathology (*Idaho Sta. Bul. 131 (1923), pp. 49–53*).—Observations and field experiments are said to have shown that the amount of moisture in the soil at planting time has a direct influence upon infection of wheat by stinking smut. Greenhouse experiments showed that the highest percentage of infection took place at a temperature of from 48 to 54° F., with a soil moisture content of about 22 per cent. Preliminary experiments are said to indicate the rapid loss in viability of smut spores in moist soils that are stirred frequently.

Investigations are reported which indicate that the potato disease known as russet dwarf is a form of mosaic. Plantings made of two varieties of potatoes in different parts of the State under varying conditions are said to have shown about the same amount of leaf roll, but the percentage of mosaic varied with climatic factors. Experiments are briefly reported in which a number of in

sects were tested as possible carriers of mosaic, but only the pink and green rose aphids, *Macrosiphum solanifolii*, transmitted the disease.

The results of seven years' experiments on the control of Rhizoctonia of potatoes are reported. Where corrosive sublimate was used as a disinfectant of the tubers the addition of 0.25 oz. for every 2 bu. of clean whole potatoes treated was found to maintain the strength of the solution. Cut or dirty potatoes reduced the strength of the solution very rapidly.

The ordinary hot formaldehyde treatment of potatoes having not proved entirely satisfactory for controlling Rhizoctonia, it was found that by sprinkling the tubers with water and covering them for from 24 to 48 hours either the formaldehyde or corrosive sublimate treatment was made more effective.

Experiments are reported which indicate that dust treatments are not as effective for the control of wheat smut as the dip method. Where seed wheat was heavily infested with smut spores and copper carbonate and copper sulphate treatments were compared, there was less smut where copper sulphate was employed, but the stand was considerably reduced by the treatment.

The application of 300 and 600 lbs. of sulphur per acre to soils proved of no value for the control of potato scab under the prevailing conditions.

A brief account is given of investigations on the stripe rust of wheat. More than 60 species of grass have been found to act as hosts for this rust. No alternate host plant has been found, and it is reported that the summer stage of the fungus winters over in Idaho on the wild grasses and on winter wheat.

[**Plant pathology studies of the Iowa Station**] (*Iowa Sta. Rpt. 1922, pp. 34, 35*).—Studies in addition to those already reported (E. S. R., 47, p. 350) have shown that the dry rot of corn due to *Diplodia zeae* enters the corn plant at the tip of the ear and at the nodes of the stalk. The fungus is said to lodge at the base of the leaves and later attacks the stalk and ear shanks and butts of the ears. Injury to the seed by the dry rot fungus has been found to be of great importance, and during germination tests the rag doll or modified rag doll was not found to give accurate results as to the number of moldy kernels. The fungus is said to secrete a strong cellulose-destroying enzym, which permits it to spread freely throughout a rag doll, and in this manner it infects good seed in the germinator.

The investigation of mosaic diseases carried on by the station has been extended to include a number of different crops, particularly cucumbers and melons. Cucumbers from mosaic-infected vines are said to be worthless for pickles, as they fail to take up the brine. Investigations have shown that the mosaics of certain species of the families Cucurbitaceae, Leguminosae, Solanaceae, and Labiatae are interchangeable, and this suggests that there is not a specific mosaic for each family of plants.

Cooperative experiments carried on in a number of localities in Iowa are said to have shown that raspberry anthracnose caused by *Plectodiscella veneta* can be successfully controlled by spraying with commercial lime sulphur, the first application to be made before the buds open, the second when the canes are from 8 to 12 in. high, and the third just as the fruit ripens.

[**An investigation of some orchard and truck crop diseases in Iowa**] (*Iowa Sta. Rpt. 1922, pp. 43, 46, 47*).—In connection with attempts to control apple diseases, comparisons were made of Bordeaux mixture and lime sulphur to determine their relative efficiency and also the effect upon foliage and fruit. The theory is advanced that burning attributed to lime sulphur is due to the oxidation of the sulphur and the formation of sulphuric acid. Laboratory tests showed that sulphur dioxid was formed when lime sulphur was heated to 115° F. Improperly mixed lime sulphur and lead arsenate are said to rapidly cause the decomposition of the chlorophyll in the leaves and fruit.

Cooperative experiments with several nurseries in the State have shown that crown gall on nursery apple trees can be reduced from 15 to 20 per cent by treating apple grafts with an 8–8–50 Bordeaux mixture.

A checking up of experiments on the control of the Illinois blister canker due to *Nummularia discreta* is said to have shown that 75 per cent of the treatments recommended were successful. The treatment suggested is the cutting out of blister cankers with a heavy gouge and mallet, and the wound then painted with a mixture of white lead, raw linseed oil, and powdered corrosive sublimate. One-half oz. of corrosive sublimate should be used to each 2 qt. of paint.

Successful efforts are reported in the production of a strain of Copenhagen cabbage resistant to cabbage yellows.

Experiments have shown that Bordeaux mixture is the most efficient agent for the control of tipburn of potatoes. An average gain of 25 per cent in yield of potatoes due to spraying with Bordeaux mixture is reported as the result of seven years' experiments.

Noteworthy plant diseases in North Carolina in 1922, F. A. Wolf (*North Carolina Sta. Rpt. 1922, pp. 74–76*).—A report is given of boll shedding of cotton associated with the fungus *Colletotrichum gossypii*, the cause of cotton anthracnose. The presumption is that infection originated about punctures made by the boll weevil, and that the insects acted as carriers of the fungus.

A leaf scorch of strawberries due to *Mollisia earliana* was observed in eastern North Carolina, some growers reporting losses of as much as from 20 to 30 per cent of their crop. A stem rot of strawberries caused by *Sclerotium rolfsii* is also reported. The same fungus was collected on tobacco plants in two localities of the State.

Downy mildew, *Plasmopara cubensis*, was reported as severe on watermelons and cantaloups in North Carolina in 1922. The presence of the wheat nematode, *Tylenchus tritici*, is reported in two counties. A leaf blight of walnuts was identified as due to *Cylindrosporium juglandis*.

Spores in the upper air, E. C. Stakman, A. W. Henry, G. C. Curran, and W. N. Christopher (*Jour. Agr. Research [U. S.], 24 (1923), No. 7, pp. 599–606, pls. 2*).—The results are given of studies of spore traps exposed on airplanes at various altitudes and at several places in the Mississippi Valley in 1921 and 1922. Many spores of different genera of pathogenic fungi, conidiophores, pollen grains, glumes of grasses, and small insects were caught on the slides. Spores and pollen grains are said to have been relatively abundant at altitudes up to 11,000 ft. They were relatively scarce at higher altitudes, but two spores of what appeared to be *Puccinia triticina* were caught as high as 16,500 ft. Alternaria spores which were caught at altitudes of 10,500 ft. and less were viable. Urediniospores and aeciospores of *P. graminis*, caught at elevations of 7,000 and 1,000 ft., respectively, also germinated.

Some graminicolous species of Helminthosporium, C. Drechsler (*Jour. Agr. Research [U. S.], 24 (1923), No. 8, pp. 641–740, pls. 33*).—On account of the importance of species of Helminthosporium known to attack various cereals and common grasses, the author made a study to determine more definitely the distinctive differences between the species which attack barley and oats and those occurring on various wild and cultivated grasses.

After briefly describing the types of injury due to the various species, a discussion is given of the taxonomic characters used in defining the species. About 25 species, 12 of which are new, are described.

Studies on the parasitism of Helminthosporium sativum, J. J. Christensen (*Minnesota Sta. Tech. Bul. 11 (1922), pp. 3–42, pls. 10, figs. 2*).—On account

of the extended distribution of *H. sativum* and its ability to attack a wide range of host species the author has carried on studies of its parasitism and has found that practically no parts of wheat, barley, rye, and various grasses are immune to its attack. The fungus was isolated from over 122 species and varieties of naturally infected cereals and grasses. At least four biological forms of the fungus are recognized, and they are said to differ physiologically by the rate and character of their growth and degrees of infection. Field and greenhouse experiments with Form I showed that the varieties Marquis, Monad, and Red Durum wheats were extremely susceptible to root infection, while Kanred was resistant. Different varieties of barley and oats were also found to vary in susceptiblity to disease. The fungus is said to overwinter as mycelium in the seed and on plants remaining in the field. Initial infections in the field and greenhouse were found due to seed infection and soil infestation, while secondary infections resulted from spores produced on primary lesions on cereals and from infected plants of the previous year.

The disease is said to be difficult to control, but proper rotation and clean seed will doubtless reduce its prevalence.

A statistical study of the comparative morphology of biologic forms of Puccinia graminis, M. N. LEVINE (*Jour. Agr. Research [U. S.], 24 (1923), No. 7, pp. 539–568, pls. 2, figs. 14*).—The results are given of statistical studies of the morphologic identity of the aeciospores, urediniospores, and teliospores of the different biologic forms of stem rust occurring on wheat, rye, oats, timothy, and redtop.

It is found that spore measurements can be employed as an additional aid in identifying the biologic forms of *P. graminis.* Biologic forms of stem rust are said to differ markedly and significantly in their various kinds of spores when produced under uniform conditions. In general, the wheat rust, *P. graminis tritici,* has larger spores of each type than any other biologic form. The oat rust, *P. graminis avenae,* occupies the second place; the rye rust, *P. graminis secalis,* the third; and timothy rust, *P. graminis phleipratensis,* the fourth, while the redtop rust, *P. graminis agrostis,* has the smallest spores of all.

Congenial hosts were not found in any way to change the morphology of stem rust spores. Resistant host plants and adverse environmental conditions tended to decrease the size of any type of spores of any biologic form.

Studies on the life history of stripe rust, Puccinia glumarum, C. W. HUNGERFORD (*Jour. Agr. Research [U. S.], 24 (1923), No. 7, pp. 607–620, pls. 4, fig. 1*).—Investigations begun by the Bureau of Plant Industry, U. S. D. A., at the Oregon Experiment Station and continued at the Idaho Experiment Station are said to indicate that stripe rust caused by *P. glumarum* may overwinter on the Pacific coast, both as mycelium and as urediniospores, on wheat and wild grasses. Some evidence was obtained which is believed to indicate that the mycelium of stripe rust may overwinter at Moscow, Idaho, on *Hordeum jubatum* and *Bromus marginatus.*

It was found that mycelium of stripe rust passes the dry summer months on the Pacific coast as dormant mycelium in the leaves of wild grasses, and it is suggested that the climatic conditions prevailing during the summer and fall will determine whether or not an epidemic of stripe rust may develop on winter wheat.

Germination tests with urediniospores of stripe rust showed that the spores may remain viable for a considerable number of days in herbarium packets or in open vials in a desiccator.

It is claimed that infection by urediniospores of stripe rust can not take place before the primary leaf of the wheat seedling has begun to expand.

The period of incubation for the uredinial stage of stripe rust was found to be between 12 and 13 days under conditions favorable for infection. Uredinia and telia of stripe rust are said to occur commonly upon kernels of certain varieties of wheat, but the results of experiments indicate that *P. glumarum tritici* is not transmitted from one wheat crop to the next by means of infected seed wheat. No infection occurred on plants grown from seed wheat which had been covered with viable urediniospores of stripe rust before sowing.

Influence of temperature, moisture, and oxygen on spore germination of Ustilago avenae, E. S. JONES (*Jour. Agr. Research* [*U. S.*], *24* (*1923*), *No. 7, pp. 577–591, figs. 3*).—Spores of *U. avenae* were found to germinate at temperatures ranging from 4 to 35° C. when grown in beef broth. The minimum temperature for germination was found to be 4 and 5°, the optimum from 15 to 28°, and the maximum between 31 and 34°. Under these conditions the minimum and optimum temperatures for sporidial production are the same as for germination, but the maximum is somewhat lower.

The relation of spore germination to moisture was studied, and it was found to be the highest at 30 per cent saturation, falling off slightly at 60 per cent, and very markedly at 80 per cent of moisture-holding capacity.

Spores of *U. avenae* failed to germinate in a suspension exposed to an oxygen-free atmosphere.

Relation of certain soil factors to the infection of oats by loose smut, L. K. BARTHOLOMEW and E. S. JONES (*Jour. Agr. Research* [*U. S.*], *24* (*1923*), *No. 7, pp. 569–575, figs. 2*).—The authors give the results of an investigation of effects of certain soil factors upon the fungus *Ustilago avenae* and upon the host plant *Avena nuda*, as well as upon the two in combination.

The temperature range for growth of *U. avenae* on potato-dextrose agar is said to be minimum 8° C., optimum 20°, and maximum 32°. For the germination of the spores in beef broth the range is minimum 5°, optimum 15 to 28°, and maximum 31 to 34°. The temperature range for sporidial production under the same conditions as for spore germination is minimum 5°, optimum 15 to 28°, and maximum 30°. The temperature range for germination of the seeds of *A. nuda* was found to be minimum 3°, optimum 18 to 20°, and maximum 33° or more. The temperature at which the seed germinated and the seedlings were maintained for two weeks is believed to influence the subsequent vigor of the plants. High soil temperatures were found to be accompanied by a marked reduction in the percentage of infection under the conditions of the experiments. Low soil temperatures were also accompanied by a reduction in the percentages of infection, but to a less degree than in the case of high temperatures.

High soil moistures combined with high soil temperatures resulted in the complete elimination of the fungus, while low soil moistures, within a certain temperature range, were accompanied by relatively high percentages of smut infection.

Influence of temperature on the spore germination of Ustilago zeae, E. S. JONES (*Jour. Agr. Research* [*U. S.*], *24* (*1923*), *No. 7, pp. 593–597, fig. 1*).—Attempts to germinate spores of *U. zeae* in soils containing various amounts of manure were said to have given unsatisfactory results. Studies of spore germination in artificial media showed the optimum temperature for the germination of *U. zeae* spores to lie between 26 and 34° C, the maximum between 36 and 38°, and the minimum 8°. The optimum and maximum for sporidial production were the same as that for the germination of the spores, while sporidia were produced at the lowest temperatures at which germination was observed.

The experiments are said to indicate that high temperature is most favorable for spore germination, suggesting that infection likewise is favored by hot weather whether the germination takes place in the soil or in water held upon the host plant.

A method of treating maize seed to destroy adherent spores of downy mildew, W. H. WESTON, JR. (*Jour. Agr. Research [U. S.], 24 (1923), No. 10, pp. 853–860*).—Suggestions are given for the treatment of seed corn from the Orient to prevent the possibility of the introduction of downy mildews and other diseases. The seed is wet with alcohol for one-half to one minute, drained, and, while still damp, covered with concentrated sulphuric acid which is allowed to remain on the seed from 5 to 10 minutes, stirred from time to time, then drained from the seed, which is to be washed for 1 hour in running water and planted at once or thoroughly dried and saved for future planting.

Preliminary experiments are said to have shown that this method of treatment destroys oospores of Sclerospora that may be adhering to the maize seed, while at the same time the vitality of the seed is but little impaired.

Other experiments have shown that the treatment can be successfully used in the case of teosinte, coix, and some varieties of sorghum.

The inheritance of growth habit and resistance to stem rust in a cross between two varieties of common wheat, O. S. AAMODT (*Jour. Agr. Research [U. S.], 24 (1923), No. 6, pp. 457–470, pls. 2, fig. 1*).—The author presents data regarding the mode of inheritance of growth and resistance in a cross between Kanred, an awned winter wheat, and Marquis, an awnless spring wheat. The segregation for growth habit characters in the progeny resulting from a cross of these varieties was found to be in accord with Mendelian laws. The results are said to indicate the presence of multiple factors for this character. In the F_2 some plants appeared which were homozygous in F_3 for a heading period which was five weeks later than that of the spring parent.

The segregation for rust reaction to Biologic Form I in the progeny of a cross between Kanred and Marquis showed a simple Mendelian ratio of approximately three immune plants to one susceptible plant. There was a dominance of immunity over susceptibility, since there were no intermediate types of infection with this rust form. The progeny of this cross were inoculated with several biologic forms of stem rust, and they showed that the reaction of the host to all of these forms was inherited as a single genetic factor.

Injury to foliage by arsenical spray mixtures, D. B. SWINGLE, H. E. MORRIS, and E. BURKE (*Jour. Agr. Research [U. S.], 24 (1923), No. 6, pp. 501–538, pl. 1*).—The results are given of an investigation at the Montana Experiment Station of the injury to foliage by arsenicals, the work having extended over a period of 10 years, during which time more than 10,000 individual plants or branches of trees were sprayed with various arsenical insecticides.

It was found that the name of an arsenical was not always indicative of its exact composition, different lots giving widely varying results. Arsenic trioxids and Paris green were the most uniform in composition. The arsenicals which were least injurious to foliage were iron arsenate and some of the lead arsenates. Some of the diplumbic arsenates were found to be as safe for use as the triplumbic ones. It is claimed that arsenic trioxid is not dangerous to foliage if applied as soon as mixed with water, but that standing increases the injury. Some of the readily soluble arsenical compounds such as cacodylic acid and sodium and potassium cacodylates, which are usually considered less harmful to animals, proved among the most injurious to plants.

Soap added to soluble arsenates is said to exert a protective action, but it increases the injury due to some insoluble arsenates. When added to Paris green the burning of foliage was distinctly restrained. Gelatin, milk, and

agar did not increase the arsenical injury to foliage. Lime sulphur solution increased the injury caused by most insoluble arsenical compounds. It decreased the injury due to calcium arsenite but not sufficiently to make its use safe. Tobacco extracts appeared to have no effect on arsenical insecticides. Lime exerted some restraining effect on injury caused by calcium arsenite and Paris green. The addition of ferrous sulphid to zinc arsenite did not decrease injury, and repeated sprayings with zinc arsenite were found to result in serious burning.

Light appeared to be an unimportant factor in arsenical injury, and increases of temperature within the usual summer range at the station did not increase injury if the air was relatively dry. Increased humidity was found to be the most important environmental factor in determining arsenical injury to foliage.

The injury due to arsenicals is said to be practically all through the lower epidermis of the leaves, regardless of the number of stomata, indicating the penetration of the cuticle which is thinner on the lower sides of the leaves.

An influence of moisture on bean wilt, L. T. LEONARD (*Jour. Agr. Research [U. S.], 24 (1923), No. 9, pp. 749–752, pls. 3*).—A report is given of investigations to determine the cause of failure of growth of navy beans at Redfield, S. Dak., when inoculated with a legume culture. The plants are reported to have been badly damaged by wilt due to *Bacterium flaccumfaciens* (E. S. R., 47, p. 148).

As a result of the study it was found that a slight application of moisture either in the form of water, certain culture bacteria in the broth form, or legume bacteria culture caused a stimulation of the bean wilt disease under the prevailing conditions. The author recommends that if the application of legume bacteria culture to beans is necessary, this material should be added in the form of naturally or artificially inoculated soil in a dry condition.

This stimulation of disease organisms was not produced with similar treatment under humid conditions and soils at the Arlington Farm, Rosslyn, Va.

New work on potato diseases in America, W. A. ORTON (*Roy. Hort. Soc., Internatl. Potato Conf. Rpt., 1921, pp. 169–179*).—In this address, besides giving a condensed discussion of the general potato disease situation in America, the author dealt briefly with malnutrition troubles, soil fungi, and potato tuber rots, leak, bacterial diseases, wart, mosaic, and leaf roll.

The study of the etiology of blackleg diseases of potatoes (*Nebraska Sta. Rpt. 1922, p. 20*).—Investigations on the viability of *Bacillus phytophthorus* under various conditions of temperature and moisture have shown that organism is very susceptible to desiccation. At 100 per cent humidity the organism remained viable for at least 8 days at all temperatures from 5 to 30° C., at 90 per cent humidity with a temperature of 25° it remained viable for only 3 hours, and at 80 per cent humidity with the same temperatures the organism lived only 1 hour. Inoculation experiments on tubers showed that at the optimum temperatures for injection no rotting occurred at humidities of 40 per cent and below.

Some recent work on the potato blight, G. H. PETHYBRIDGE (*Roy Hort. Soc., Internatl. Potato Conf. Rpt., 1921, pp. 112–126, figs. 12*).—In a somewhat general bibliographical review of recent work and opinion regarding potato late blight, it is stated that in pure cultures on Quaker oat agar *Phytophthora infestans* often develops oospores in oogonia in the absence of antheridia; that is, parthenogenetically. It is thought possible that such parthenogentic spores may occur in nature.

[Degeneration of potatoes in Idaho] (*Idaho Sta. Bul. 131 (1923), p. 47*).—A report is given on the growing of two varieties of potatoes for two consecu-

tive years without any effort being made to eliminate diseased plants by roguing in the field. Marked reductions in yield and in the percentage of marketable tubers are reported.

The study of degeneracy in potatoes (*Nebraska Sta. Rpt. 1922, pp. 10, 11*).—A brief account is given of a comparison of two strains of Triumph potatoes which were grown on dry land and also on irrigated land. Both strains were grown under irrigation in 1922, and the following yields were obtained: From dry-land tubers, 100 per cent; seed from potatoes that had been grown under irrigation for 1 year, from 85 to 90 per cent; for 2 years, from 60 to 75 per cent; for 3 years, from 40 to 65 per cent; and for 4 years, less than 40 per cent.

It is thought that degeneracy takes place more rapidly in irrigated fields on account of the close proximity of potato fields, and also the more favorable conditions for insects which probably act as carriers of the disease.

Degeneration of potatoes, R. N. SALAMAN (*Roy. Hort. Soc., Internatl. Potato Conf. Rpt., 1921, pp. 79–91, figs. 4*).—The results of experience during 16 years in systematic potato breeding have supported the general conclusion that potato degeneration is the result of some form of disease and not of what has been called senility. Leaf curl may be a form of mosaic. The hope of the potato raiser lies in the breeding of resistant varieties.

Leaf curl and mosaic disease of potatoes and their relation to deterioration in yield (*Fruit, Flower, and Veg. Trades' Jour.* [*London*], *41* (*1922*), *No. 19, pp. 529, 530*).—Experiments have been extensively carried out to demonstrate the deterioration in cropping power and vigor which takes place if home-grown potato seed is planted year after year.

Both leaf curl and mosaic are described, with an account of experiments on the former on the farm of the University College of North Wales in 1921 as one of a series testing the actual loss due to leaf curl. As compared with the crop from seed of disease-free Arran Comrade, the crop from seed of the same variety very slightly though generally affected with leaf curl showed about half as many large and seed tubers, and about twice as many small potatoes.

The situation with regard to leaf curl and mosaic in Britain, A. D. COTTON (*Roy. Hort. Soc., Internatl. Potato Conf. Rpt., 1921, pp. 153–168*).—Such observations and experiments as have been made tend to confirm the discoveries of Dutch and American workers that potato leaf curl and mosaic are highly infectious, and that the virus is carried by aphids. In case of leaf curl a loss of 60 per cent may take place in all parts of England, even if seed is obtained from the very best sources. In mosaic the loss is apparently not quite so high, though reliable figures on a field scale are not yet available. Marked varietal susceptibility is manifest on observation, though control experiments are required.

The distribution of the two diseases in England, Scotland, and Wales is outlined. They are much less prevalent in the northern and upland areas. The comparative freedom from these diseases in certain districts is believed to be due mainly to the milder attacks or later infestations of the virus-carrying aphids. Susceptible varieties may remain perfectly free from disease in the north of Scotland, while introduced diseased stocks of the same variety retain the disease.

The relative importance of meteorological conditions, soil conditions, and the presence of other host plants in favoring the aphis attack is discussed, with emphasis on the need for research. It is shown that deterioration of potatoes as ordinarily understood is not a physiological phenomenon but is due to definite infection by a virus disease. The general idea of deterioration as a result of continued nonsexual propagation is criticized, the behavior of the

potato and many other garden and field plants rendering it little, if any, support.

Practical recommendations are offered.

New work on leaf curl and allied diseases in Holland, H. M. QUANJER (*Roy. Hort. Soc., Internatl. Potato Conf. Rpt., 1921, pp. 127–145, pls. 2, figs. 18*).—Leaf curl, mosaic, and crinkle, the more important diseases of potato recently studied by the author, are discussed in some detail as regards features and control measures.

Some recent work on leaf roll and mosaic, P. A. MURPHY (*Roy. Hort. Soc., Internatl. Potato Conf. Rpt., 1921, pp. 145–152, pl. 1*).—A partial survey carried out in 1920 showed that potato leaf roll occurred in Ireland, both this disease and mosaic being somewhat more common than had been supposed, particularly on certain varieties.

It has been found that infection can be conveyed from potatoes in which the disease is latent and practically innocuous to neighboring healthy potatoes. The suppression of mosaic is held to be due to a measure of immunity of the plants in question. The differences noted in this study appear to be comparable to the specialization in parasitism found in other organisms which cause disease in plants. Relations between these and other diseases are briefly discussed.

As to the control of leaf roll and mosaic, very little positive information is available. The definite information is summed up in the statement that the qualities of the seed potato which have the greatest influence on productiveness can not at present be judged by the appearance of the tuber, but are most readily judged by the appearance of the plant which produced the tuber.

The nature of immunity from wart disease, V. H. BLACKMAN (*Roy. Hort. Soc., Internatl. Potato Conf. Rpt., 1921, p. 92*).—A condensed review of the contribution by Curtis (E. S. R., 47, p. 248) stresses the importance of further analysis (now in progress) of the real nature of the differences between immune and susceptible varieties.

Some research aspects of the wart disease problem, W. B. BRIERLEY (*Roy. Hort. Soc., Internatl. Potato Conf. Rpt., 1921, pp. 93–104*).—Considering the fact that potato varieties immune to wart disease are divided discontinuously from all others, which show heterogeneity amounting practically to a continuous shading out of the quality of resistance, the author emphasizes the probability of the presence of some completely specific substance such as a particular alkaloid or glucosid as an integral factor in the metabolic structure of the immune varieties. This is supported by the fact that all parts, if any, are immune to wart disease. No solution of the problem appears except the absolute one of avoidance of all but immune varieties as planting material. Other possibilities and views are discussed.

Some information on the heredity of immunity from wart disease, R. N. SALAMAN and J. W. LESLEY (*Roy. Hort. Soc., Internatl. Potato Conf. Rpt., 1921, pp. 105–111*).—It appears clear from experimentation begun in 1909 that potato varieties may be divided into two groups, susceptible and immune. No external conditions, however favorable, can ever oppose to a parasite the absolute resistance it meets in an immune variety. Differences in degree of susceptibility probably exist.

The object of the experimentation reported in this preliminary paper was to determine whether immunity is controlled by Mendelian factors; and if so, in what manner. The method and data as briefly detailed show immunity and susceptibility to be each of two kinds, dependent upon factors indicated. The evidence indicates that immunity and susceptibility to wart disease can not be completely expressed by a single pair of factors. Both immunes and

susceptibles seem to belong to several genotypes. So far as it goes the evidence suggests that no advantage is to be expected from making a cross in one direction rather than in the other. Apparently it is the factorial composition of the respective parents which is important. No correlation has been observed between behavior to wart disease and flower color or tuber color.

Influence of some nitrogenous fertilizers on the development of chlorosis in rice, L. G. WILLIS and J. O. CARRERO (*Jour. Agr. Research [U. S.], 24 (1923), No. 7, pp. 621–640*).—As a result of their investigations at the Porto Rico Federal Experiment Station, the authors conclude that the development of chlorosis of rice on calcareous soils may be governed by the nature of the nutrients supplied. Those compounds represented by sodium nitrate, calcium nitrate, and ammonium phosphate which, in themselves or by virtue of an unassimilable ion, are the cause of the precipitation of iron, are associated with chlorosis, while plants supplied with ammonium sulphate in which the unassimilable radicle may serve as a solvent for iron may be thrifty and of normal color.

The authors believe that the observation that nitrates are less suitable than ammonium salts for the fertilization of young rice plants may be based on the influence on the plants at the period of greatest absorption of nitrogen of the unassimilated residues of the fertilizer, rather than on the inferiority of nitric nitrogen as a nutrient. It is considered probable that the injury which has heretofore been ascribed to the toxic effect of nitrites, derived from nitrates by reduction, was a manifestation of chlorosis caused by the action of basic residues of the nitrate salts used as nutrients.

Species of Rhizopus responsible for the decay of sweet potatoes in the storage house and at different temperatures in infection chambers, J. I. LAURITZEN and L. L. HARTER (*Jour. Agr. Research [U. S.], 24 (1923), No. 6, pp. 441–456, fig. 1*).—In a previous publication (E. S. R., 48, p. 547) an enumeration has been given of species of Rhizopus which inoculation experiments showed were capable of producing soft rots of sweet potatoes. Subsequent investigations indicate that *R. nigricans* and *R. tritici* are the species primarily responsible for the decay of sweet potatoes known as soft rot, *R. nigricans* at temperatures between 6 and 20° C., and *R. tritici* at 30° and above, the two overlapping between 20 and 30°.

The temperature range of infection by *R. tritici*, *R. nigricans*, and *Mucor* sp. is said to be so wide as to exclude the possibility of storing sweet potatoes beyond the limits of this range.

R. tritici, *R. oryzae*, *R. reflexus*, and *R. artocarpi* can not compete successfully with *R. nigricans* at temperatures of 12, 14, and 18°.

Apple blotch, M. W. GARDNER, L. GREENE, and C. E. BAKER (*Indiana Sta. Bul. 267 (1923), pp. 32, figs. 12*).—The authors summarize information regarding apple blotch due to *Phyllosticta solitaria* and present the results of 4 years' experiments in control of the disease. Apple blotch is said to be very prevalent in southern Indiana, particularly on such varieties as Northwestern, Oldenburg, and Ben Davis. Twigs, buds, and leaves are subject to injury in addition to the fruit. It has been found that the fungus can remain alive and active for 7 or 8 years in cankers on the branches. Most of the infection is said to occur during a period of about 7 weeks after petal fall. The fungus grows down into the twigs from lesions on leaf petioles, and most of the cankers on bearing wood are said to originate in this manner. Cankers have been found in abundance on nursery stock and on seedlings used for budding purposes.

In experiments for the control of this disease, dormant sprays were found ineffective, and dusts gave very poor control. Bordeaux sprays applied 2, 4, and 6 weeks after petal fall were usually effective in preventing fruit, leaf, and

twig infection. Lime sulphur did not prove as reliable as Bordeaux mixture for canker control. A 2–4–50 Bordeaux mixture proved as effective as stronger solutions.

For the treatment of nursery stock the authors recommend the eradication of blotch by spraying annually to prevent new cankers and cutting out old cankers in early spring. Cankers on the trunks and large limbs are shallow and can be readily shaved off with a sharp knife without injury to the underlying cambium. When properly made, no disinfectant or wound dressing is needed for the cuts.

Apple rosette, O. M. Morris (*Washington Col. Sta. Bul. 177 (1923), pp. 30, figs. 8*).—A detailed account is given of investigations on this apparently nonparasitic disease of apples and pears, a summary of which has been noted previously (E. S. R., 49, p. 248).

Restoring chlorotic pear trees, S. Goliński (*Pam. Państ. Inst. Nauk. Gosp. Wiejsk. Puławach (Mém. Inst. Natl. Polonais Écon. Rurale Puławy), 1 (1920), A, No. 1, pp. 5–8*).—Chlorosis in dwarf pear trees has been eliminated by the use of green manures composed of peas, vetch, lupines, and horse beans, with the addition of small quantities of barley and oats. The admixture has had a beneficial influence on the soil structure and its microflora. Manuring with mineral salts according to the scheme of Wagner (ammonium sulphate, superphosphate, and potassium sulphate) has had no effect on the elimination of cholorosis in dwarf pear trees.

Mosaic and other systemic diseases of brambles in Oregon, S. M. Zeller (*Oregon Sta. Circ. 49 (1923), pp. 15, figs. 9*).—Popular descriptions are given of mosaic, leaf curl, and bramble streak in Oregon. The mosaic disease is reported as affecting loganberries, blackberries, and black and red raspberries. Leaf curl is almost entirely confined to red raspberries, and the bramble streak disease is usually confined to black raspberries. Different varieties vary in their susceptibility to the disease.

For the control of these diseases the author recommends the roguing of diseased plantings, the use of clean nursery stock, and, as a precaution against the spread of mosaic in loganberry and blackberry plantings, that the canes be trained so that those of one plant will not come in contact with those of another.

A study of decay in Douglas fir in the Pacific Northwest, J. S. Boyce (*U. S. Dept. Agr. Bul. 1163 (1923), pp. 20, pls. 8*).—On account of the importance of definite knowledge regarding the extent of decay in Douglas fir the author conducted an investigation of the subject. By far most of the decay was found to be due to four species of fungi, *Trametes pini, Polyporus schweinitzii, Fomes laricis,* and *F. roseus.* The different kinds of rots produced by these fungi are described at length. Further investigation is said to be needed so that the estimation of the stand of Douglas fir timber may be placed on a more exact basis.

Control of snow molding in coniferous nursery stock, C. F. Korstian (*Jour. Agr. Research [U. S.], 24 (1923), No. 9, pp. 741–748, pls. 3*).—Losses from snow molding of coniferous nursery stock have been so great as to cause the abandonment of growing coniferous seedlings, especially Douglas fir, at the Cottonwood Nursery of the U. S. Forest Service near Salt Lake City, Utah. This trouble was found to be due very largely to *Botrytis cinera* (E. S. R., 43, p. 846), but the use of fungicides did not control it.

According to the author, all age classes and species of seedlings, except lodgepole pine, grown in this nursery were subject to this disease, and it was more prevalent among young seedlings than those in the older age classes.

It is claimed that the disease can be controlled in the nursery by placing a protective framework over the bed so that the full weight of the snow does not lie heavily on the trees. This proved to be the best and most efficient method of control that has been developed.

ECONOMIC ZOOLOGY—ENTOMOLOGY.

The animal and its environment, L. A. Borradaile (*London: Henry Frowde and Hodder & Stoughton, 1923, pp. VII+399, pls. 4, figs. 426*).—Several of the 15 chapters of this work deal, respectively, with physical factors in the surroundings which affect the lives of animals (pp. 17–37); organisms as factors in the surroundings which affect the lives of animals, special relations between animals and plants (pp. 38–75); relations between animals of different species (pp. 76–121); relations between animals of the same species (pp. 122–150); relations between the sexes (pp. 151–176); the land fauna (pp. 269–311); the evolution of faunas (pp. 312–339); migration (pp. 340–360); internal parasites (pp. 361–373); and the influence of the surroundings upon the animal organism (pp. 374–382).

Mammals of Utah, C. T. Barnes (*Utah Univ. Bul., 12 (1922), No. 15, pp. 166+[10], figs. 31*).—The author gives descriptions of 121 mammals occurring in Utah, together with accounts of the distribution and the habits of each.

Controlling rodent and other small animal pests in Oregon, I. N. Gabrielson (*Oreg. Agr. Col. Ext. Bul. 361 (1923), pp. 20, figs. 2*).—This is a popular summary of information.

[Trapping moles] (*Iowa Agr., 24 (1923), No. 3, pp. 55, 56, fig. 1*).—In control work at Ames, Iowa, investigations by E. D. Dunham have shown the Nash loop or choker type trap to be by far the most effective of the traps tested, 70 of the 75 moles taken having been caught in four of these loop traps.

Life histories of North American wild fowl: Order Anseres, A. C. Bent (*U. S. Natl. Mus. Bul. 126 (1923), pp. IX+250, pls. 46*).—In this continuation of the work previously noted (E. S. R., 48, p. 150) the author deals with the family Anatidae, which includes ducks, geese, and swans.

[Report on Idaho Station work in] entomology (*Idaho Sta. Bul. 131 (1923), pp. 35–38*).—The alfalfa weevil parasite *Bathyplectes curculionis*, which was introduced into the Parma community in 1921, has become established and seems to be assisting materially in controlling the weevil.

A study was made of the false wireworms (Eleodes), of which eight species have been found to occur in the area under investigation in eastern Idaho, but only one, *E. hispilabris*, in sufficient abundance to warrant control investigations. The eggs of this beetle are laid most abundantly in June, and the larvae, hatching out in 1.35 days, do serious damage to spring and fall planted wheat by destroying the germ in the seed, by killing the developing sprout, and by feeding on tender leaves below the surface of the ground. In cooperative work with farmers over an area of approximately 18,000 acres, beetles were effectively killed by use of a poison mash made of bran, Paris green, amyl acetate, and water, distributed broadcast or in the bottoms of plow furrows, at a cost for material of about 2.5 cts. per acre. It is stated that two men and a team readily treated 320 acres per day.

In codling moth work, life history observations in Madison County indicate that 73.3 per cent of the spring brood of larvae transform to moths of a second generation, and the remaining 26.7 per cent enter hibernation. The fruit-tree leaf-roller is said to occur in eight counties of the State, being established in every fruit raising locality.

Insect outbreaks of the year are briefly referred to.

[Report of Iowa Station work on] entomology (*Iowa Sta. Rpt. 1922, pp. 39–43*).—In control work with the potato leafhopper, experiments were conducted to determine the susceptibility of five varieties of Irish potatoes to hopperburn. It was found that Bliss Triumph, certain strains of Early Ohio, and Irish Cobbler are the most susceptible, in the order mentioned. The Early Ohio northern seed is more resistant than any of the above-mentioned varieties and strains, but not as much so as Green Mountain; and while this variety withstands hopperburn fairly well under northern Iowa conditions, it is not as immune as Rural New Yorker. The degree of susceptibility is dependent on certain factors not yet determined.

In work conducted with a view to determining the effect of the date of planting on the degree of hopperburn, it was found on July 25 that plantings made April 18 were dead, due to hopperburn, while plantings made on May 9 and June 14 were in good condition. The tests show that the date of planting has a decisive influence on the severity of hopperburn.

"Spraying tests with five commercial dry Bordeaux powders and five different combinations of self-prepared Bordeaux show that under certain conditions a good commercial brand is as effective, if not more so, than the 4–4–50 homemade preparation, and that a 4–6–50 or 4–8–50 self-prepared Bordeaux is superior to the 4–4–50, 4–12–50, or 5–5–50 combinations. Dusting three times with a copper arsenate dust failed to give satisfactory results. The chief difficulty with a dry Bordeaux powder mixed with water is its inability to stick to the foliage well after a driving rain." Experiments made with a view to determining the effectiveness of different types of stickers showed Kayso (casein) to be better than glue so far as protection from hopperburn is concerned. It is thought that by adding some sticker, as Kayso, to a good brand of dry Bordeaux a very effective spray will be developed that will control the leafhopper.

It is concluded that hopperburn can be controlled in northern Iowa (1) by planting a resistant variety such as Rural New Yorker, (2) by planting comparatively late in order to escape the spring flight of the leafhopper, and (3) by spraying at least three times with 4–6–50 self-prepared Bordeaux, or a good brand of dry Bordeaux powder to which some sticker, such as Kayso, is added.

Mention is made of several insect outbreaks during 1922, including the apple bud aphis (*Siphocoryne avenae* Fab.), which caused serious injury to apple buds where nicotin was not applied, the chinch bug, stalk borer, and the Hessian fly, which cut wheat yields considerably throughout the wheat belt.

The report also deals with honey flow conditions in 1922, determination of sources of honey, of the proportion of bees in a colony that work in the field, rate of departure of bees going to the field, and the Demaree method of swarm control. It is reported that one colony under observation, which comprised 40,000 bees, brought in 4 lbs. of honey in a single day. The rate of departure of fielders from the hive averaged 10,000 per hour.

Report of the division of entomology, F. Sherman (*North Carolina Sta. Rpt. 1922, pp. 54–61*).—Work with the larger cornstalk borer (*Diatraca zeacolella* Dyar) has been previously noted (E. S. R., 45, p. 58), as well as the work in potato spraying and flea-beetle control (E. S. R., 44, p. 436). The author has found that 1 lb. of laundry soap to 4 gal. of water is effective against cabbage, rose, black peach, turnip, and other aphids with the exception of a chrysanthemum aphid. Notes are also given of progress in an insect survey of North Carolina, cabbage and collard dusting for worms, cotton boll weevil, peach and plum curculio, fall cankerworm, control of the peach borer, and the bean leaf beetle *Epilachna corrupta*, etc.

Insect pests of the cultivated cotton plant, II–IV, W. W. FROGGATT (*Agr. Gaz. N. S. Wales, 34 (1923), Nos. 1, pp. 61–64; 3, pp. 209–212; 5, pp. 343–348*).—In continuation of the paper previously noted (E. S. R., 48, p. 550), the author deals in part 2 with the boll weevil and the pink bollworm; in part 3 with cotton stainers and other plant bugs, four species in particular being considered, namely, the Rutherglen bug (*Nysius vinitor* Berg.), the coon bug (*Oxycarenus luctuosus* Montrz.), the red cotton bug (*Dysdercus sidae* Montrz.), and the parti-colored cotton bug (*Oncopeltus quadriguttatus*); and in part 4 with cutworms and leaf-eating beetles, seven species being considered, namely, the bollworm, black cutworm, spotted yellow maize moth (*Cognogethes punctiferalis*), gray-streaked moth or Egyptian cotton worm (*Prodenia littoralis*), army worm, red-shouldered leaf-beetle (*Monolepta rosea*), and the 28-spotted ladybird beetle (*Epilachna 28-punctata*).

The pests of cotton in the Anglo-Egyptian Sudan, H. W. BEDFORD (*Wellcome Trop. Research Lab. Ent. Sect. Bul. 19 (1923), pp. 38+[9]*).—This is a summary of information on the insect enemies of cotton in the Anglo-Egyptian Sudan, which includes accounts of their distribution, economic importance, and measures recommended for control.

Work of the division of entomology, E. JARVIS (*Queensland Bur. Sugar Expt. Stas. Ann. Rpt., 22 (1922), pp. 52–56*).—This report consists of an account of the occurrence of and work with the more important insect enemies of sugar cane during the year.

The suppression of insect pests and fungoid diseases (*Bur. Bio-Technol., Leeds, Bul. 9 (1923), pp. 21–26*).—The author deals with the fumigation of commercial glasshouses in the growing season.

Nicotin petroleum emulsion, a combined insecticide (*Bur. Bio-Technol., Leeds, Bul. 9 (1923), pp. 27–31*).—The author concludes that nicotin petroleum emulsion should find extensive use among commercial growers generally.

Experiments in the control of the apple sucker (Psyllia mali Sch.) in the adult stage, W. H. BRITTAIN (*Sci. Agr., 3 (1923), No. 6, pp. 212–218; also in Jour. Pomol. and Hort. Sci., 3 (1923), No. 2, pp. 106–112*).—In this paper the author deals with open air tobacco fumigation, the use of which has been favorably reported upon from Russia. The experiments with *P. mali* (E. S. R., 49, p. 153) indicate that fumigation with 360 lbs. to the acre of tobacco waste free from incombustible material will give good control under favorable conditions.

"It is unnecessary to use hay as a starter for fires, as they burn quite well without such assistance. We have used damp vegetation to prevent the material from blazing up, but it seems likely that watering with a sprinkling can would have the same effect and would shorten the work. The fires can be ignited most rapidly by the use of a torch, rather than with matches. Numerous small fires are better than a few large ones. Where the latter are used on a still day, the smoke has a tendency to ascend directly upward and be lost. It is of advantage also to have a number of heaps held unlighted in reserve, so that, in the event of a wind suddenly arising or changing its original direction, these reserve heaps may be transferred to the windward side of the orchard."

Distribution of the European elm scale, A. HARTZELL (*Iowa Acad. Sci. Proc., 28 (1921), pp. 201–205, fig. 1*).—The author has compiled and here presents locality records of *Gossyparia spuria* Modeer. for the United States and Canada.

Studies in the physical ecology of the Noctuidae, W. C. COOK (*Minnesota Sta. Tech. Bul. 12 (1923), pp. 3–38, figs. 14*).—In this paper the author presents

the results of an attempt to determine the effects of various meteorological factors on the distribution, seasonal abundance, and activity of certain species of the family Noctuidae. The meteorological relations of the army worm, *Lycophotia margaritosa*, and the pale western cutworm (*Porosagrotis orthogonia*) are reported upon.

The work, much of which is presented in tabular form, has led to the following conclusions: "Each of the species included in this study has a very definite optimum soil moisture requirement, which, broadly speaking, limits the distribution of the species. This requirement may be determined experimentally under controlled conditions and also indirectly by a statistical analysis of the weather conditions surrounding outbreaks of that species. In each case the optimum moisture requirement of the species which occur in any given region is a close approach to the normal climatic condition in that region, so that outbreaks would occur every season were it not that there is also a necessary seasonal sequence of conditions which must be fulfilled in order to enable the insect to reach destructive abundance. This sequence, which may operate either by favoring the destructive insect, by limiting the activities of its enemies, or both, is the controlling factor in the production of outbreaks, and a careful study of such a sequence in the life history of any insect should enable us to predict the possibility of an outbreak of that insect in any given region."

A list of 30 references to works especially valuable in this study is included.

How to foretell outbreaks of the pale western cutworm in the prairie provinces, H. L. Seamans (*Canada Dept. Agr., Ent. Branch Circ. 12 (1923), pp. 3, figs. 2*).—A brief popular account.

The pink bollworm in the Belgian Kongo, J. Ghesquière (*Bul. Agr. Congo Belge, 14 (1923), No. 1, pp. 178–188, figs. 8*).—A discussion of the geographical distribution and economic importance of *Gelechia gossypiella* in Africa.

An unusual outbreak of the orange basket worm (Palatoeceticus gloverii Pack.), C. M. Hunt (*Fla. Plant Bd. Quart. Bul., 7 (1923), No. 3, pp. 159–165, figs. 5*).—The author records outbreaks of *P. gloverii* which took place at Avon Park and Sebring, Fla., in 1923, 50 per cent of the orange crop in a grove at the latter place having been damaged.

The tobacco leaf-folder of Porto Rico attacks tomatoes in Mississippi, J. M. Langston (*Miss. State Plant Bd. Quart. Bul., 2 (1923), No. 4, pp. 7–9*).—The author records the attack of tomatoes at Ocean Springs, Miss., by *Pachyzancla periusalis* Wlk., which rolls up the leaves.

Arsenical spray experiments for the control of codling moth in pears at Elsenburg, F. W. Pettey (*Union So. Africa Dept. Agr., Sci. Bul. 26 (1922), pp. 12*).—Studies here reported, the details of which are presented in tabular form, were conducted with a view to determining (1) the advisability of substituting calcium arsenate (a cheaper arsenical) for lead arsenate in the control of this pest, (2) the more effective control of codling moth by the addition of a calcium caseinate spreader to the lead arsenate and water mixture, and (3) the influence of lime sulphur and Bordeaux mixtures on the efficiency of lead arsenate in the control of this insect.

The author finds that the effectiveness of calcium arsenate when used as a dust for codling moth control is not sufficient to recommend its use to the fruit grower until much better results have been obtained under South African conditions. Experiments carried out at Elsenburg during the last two years clearly indicate that neither lime sulphur nor Bordeaux, when used as a combination spray with lead arsenate at the concentration usually advised, destroys the efficiency of lead arsenate in codling moth control any more than

from 1 to 5 per cent. "It appears that an increase from 1.25 lbs. of lead arsenate powder to 1.5 lbs. in 40 imperial gallons of water prevents slightly the influence of the fungicides on the efficiency of lead arsenate, but not sufficiently to warrant this increase in concentration."

Calcium caseinate, used in the Elsenburg experiments and made according to Lovett's formula, by mixing thoroughly 1 lb. of fine hydrated lime with 5 lbs. of fine casein obtained from a creamery, was added slowly to each 40 gal. of diluted lead arsenate in the spray tank while being vigorously stirred, this resulting in a soapy solution. It did not increase the efficiency of the lead arsenate for the control of codling moth, although the material appeared to spread well and formed a more uniform covering over the surface of the fruit than did a solution of lead arsenate and water only.

New Olethreutidae from eastern United States (Lepidoptera), C. HEINRICH (*Ent. Soc. Wash. Proc., 25 (1923), No. 5–6, pp. 105–122*).—The author erects the genus Sereda and describes 18 species as new to science, including *Episimus tyrius*, which attacks the terminal shoots of silver maple at Westbury Station, N. Y.

Nonhuman host records of Wohlfahrtia (Diptera), R. C. SHANNON (*Ent. Soc. Wash. Proc., 25 (1923), No. 5–6, p. 142*).—The author records the parasitism of a young rabbit by the maggots of *W. vigil* in such numbers as to cause its death, about 10 maggots having been observed.

Pupae of the walnut hull maggot living two years (Rhagoletis suavis Loew), J. C. BRIDWELL (*Jour. Wash. Acad. Sci., 13 (1923), No. 12, pp. 262, 263*).—The author finds that under certain conditions walnut hull maggots may not complete their transformations in a single year, but remain in the puparium two years if not more.

Nicotin dust kills cucumber beetles, J. E. DUDLEY, JR., H. F. WILSON, and W. D. MECUM (*Wisconsin Sta. Bul. 355 (1923), pp. 10, figs. 4*).—In cooperative work at Madison between the U. S. Department of Agriculture and the station over 60 different insecticides have been tested on the striped cucumber beetle. Of these, nicotin dusts have been found most effective in killing the beetle outright. Nicotin dusts containing copper sulphate or gypsum mixed with the lime carriers do not lose strength rapidly and have been found effective against the beetle under all conditions. Dusts that contain 10 per cent nicotin sulphate are most effective, but where this strength can not be purchased the 5 per cent dusts will do much to prevent the damage. A dust containing 8 per cent nicotin sulphate and 25 per cent copper sulphate is believed to be the most stable and thus the most reliable to use against this pest, but such a dust does not appear to be on the market at the present time.

"Nicotin dusts with active carriers, such as hydrated lime and unslaked lime, lose strength rapidly and control the beetle only under the most favorable conditions. Cucurbits should be dusted early, as soon as they are up and beetles commence to attack them. Early dusting kills beetles, saves time, expense, and the crop. Dusting should be done cooperatively by all growers of the neighborhood because beetles can fly as far as 2 miles. Three applications of dust during a 10-day period will usually be enough to secure control if your neighbors do likewise.

"Dusting should be done properly, using a hand duster and applying enough dust to thoroughly cover the plants, beetles, and cracks in the ground. Dust should be applied rapidly to prevent any beetles flying away, and to accomplish this a canvas cone is helpful. Fourteen pounds of dust per acre, costing $2.25 (for 5 per cent dust), will be required when plants are small. Dust stronger in nicotin will cost from one-third to one-half more. Wind reduces

effectiveness of nicotin dusts. Dusts are most effective when no wind is blowing and the temperature is 65° F. or higher, but dusting should not be put off long on account of weather conditions."

Tables of the genera of Coleoptera of France, C. HOULBERT (*Trav. Sci. Univ. Rennes, 16 (1922), pp. 1–288, figs. 705*).—This consists of illustrated keys to the genera of Coleoptera occurring in France.

A trip to Mexico for parasites of the Mexican bean beetle, E. G. SMYTH (*Jour. Wash. Acad. Sci., 13 (1923), No. 12, pp. 259, 260*).—In the course of investigations in Mexico, the author failed to find a parasite of either the egg or adult of *Epilachna corrupta* Muls. A tachinid which represents a new genus and new species was found attacking the larva. What was apparently the same fly was also found to attack a related beetle, *E. mexicana*, in the vicinity of Mexico City and at Cuernavaca. The first puparium of this tachinid was reared from an Epilachna larva on August 31, and from that time the flies increased in numbers until early October, by which time they were parasitizing from 30 to 50 per cent of *E. corrupta* larvae. The establishment of this parasite in Alabama is being attempted.

Wireworm control, R. C. TREHERNE (*Canada Dept. Agr. Pamphlet 33, n. ser. (1923), pp. 6, figs. 3*).—A brief popular account.

Controlling the Australian tomato weevil (Desiantha nociva), E. K. BYNUM (*Miss. State Plant Bd. Quart. Bul., 3 (1923), No. 1, pp. 22–24*).—Experiments conducted on a farm 8 miles north of Biloxi, Miss., and here reported in tabular form show that 2 lbs. of lead arsenate to approximately 50 gal. of water is apparently an effective control when the leaves are thoroughly covered.

Notes on the Australian tomato weevil (Desiantha nociva), E. K. BYNUM (*Miss. State Plant Bd. Quart. Bul., 2 (1923), No. 4, pp. 12–16, figs. 3*).—A brief account of a weevil which was found at McHenry, Miss., during the latter part of March, 1922, this being the first record of its occurence in the United States. Infestations have since been discovered at several points along the coast. Serious damage by it has been noticed on turnips, tomatoes, and potatoes, while a number of other truck and garden crops have been attacked.

The 1921 outbreak of the clover leaf weevil in Iowa, H. E. JAQUES (*Iowa Acad. Sci. Proc., 28 (1921), pp. 127–129, figs. 2*).—The author here records a severe outbreak of *Hypera punctata* Fab. which took place in Iowa.

The control of white pine weevil (Pissodes strobi) by mixed planting, H. C. BELYEA (*Jour. Forestry, 21 (1923), No. 4, pp. 384–390, fig. 1*).—This is a report of studies, undertaken for the purpose of comparing the liability of white pine to the white pine weevil attack in pure and mixed stands, which were conducted near Fulton, N. Y.

The results, details of which are presented in tabular form, show that the planting of pure plantations of white pine in central and western New York constitutes a severe hazard to the species in regard to the liability of white pine weevil infestation, there having been 73.4 per cent infestation. It is concluded that the planting of mixed plantations with white pine where Scotch pine is the introduced species does not greatly lessen the liability of infestation to the plantation as a whole (only about 10 per cent).

"Scotch pine, while not so susceptible as white pine, is liable to white pine weevil infestation even where planted in pure stands, where the infestation may affect between 20 and 25 per cent of the number of trees. The degree of this susceptibility, however, is less than one-third of that of white pine planted pure. This susceptibility will be increased considerably by mixed planting with white pine. The use of Scotch pine with white pine in mixed planting under the conditions described in this article has reduced the amount

of infestation in white pine by almost 40 per cent. While Scotch pine in mixed plantations is just about as susceptible to weevil infestation as the white pine, the fuller use of this method is more than justified on the basis of the lessened infestation in the white pine over that in pure plantations of the species. The Scotch pine here acts as a trap tree."

It is believed that mixed planting offers a method of control of the white pine weevil. While it does not offer absolute protection to the white pine, it does result in relative protection and reduces materially both the severity and duration of the infestation.

The A B C and X Y Z of bee culture, A. I. and E. R. Root (*Medina, Ohio: A. I. Root Co., 1923, rev. and enl. ed., pp.* [8]+*960, figs. 800*).—This is the 1923 edition of the work previously noted (E. S. R., 43, p. 661), in which many new subjects are presented.

Beekeeping in Oregon, H. A. Scullen (*Oreg. Agr. Col. Ext. Bul. 360 (1923), pp. 32, figs. 17*).—This is a revision and enlargement of an earlier noted extension bulletin, by Lovett (E. S. R., 43, p. 457).

Apiculture, E. Alphandery (*Le Livre de l'Abeille. Paris: S. Bornemann, 1922, pp. 303, figs. 303*).—This is a practical summary of information on beekeeping.

Apiculture in the tropical colonies, P. Hermann (*Apiculture Pratique aux Colonies Tropicales. La Chapelle-Montligeon (Orne): Impr. de Montligeon, 1920, pp. 90, pl. 1, figs. 48*).—This is a practical summary of information.

FOODS—HUMAN NUTRITION.

Progress and problems in the modern science of nutrition, B. Sjollema (*Ergeb. Physiol., 20 (1922), pp. 207–406*).—This is an extensive review and discussion of the literature of the past decade on vitamins, proteins, and salts in human nutrition. The author classifies foods of animal and vegetable origin into two groups, one of which is actively concerned in the metabolism of the body and the other of which serves more in the storage of food supplies in the body. Under the first head are included materials furnishing salts and vitamins and under the other the energy factors and protein.

Energy expenditure and food requirements of children at school, E. M. Bedale (*Roy. Soc. [London] Proc., Ser. B, 94 (1923), No. B 662, pp. 368–404, fig. 1*).—This extensive investigation was conducted at a boarding school for boys and girls in Hampshire, England, between June, 1919, and June, 1921. The work included computations of the daily energy output of the children by the method of indirect calorimetry, using suitable modifications of the Douglas apparatus, and also a detailed study of the actual food consumption of a considerable number of individuals. The respiratory observations in the school proper included 36 of basal metabolism on boys and 51 on girls between 11 and 18 years of age, and a total of about 800 experiments were carried out to determine the caloric cost of the school activities. From these data average values were calculated for typical children of different ages. The junior school consisted of about 30 boys and girls, who were boarding students and a variable number of day pupils, but nearly all from 8 to 12 years of age. About 140 observations were made.

The results obtained for basal metabolism for both groups are given in the accompanying table. In discussing these values, attention is called to the fact that the figures obtained for boys of 14, the boy of 12, and the girl of 14 were not representative.

Average basal metabolism of boys and girls.

Boys.						Girls.					
Number of studies.	Number of individuals.	Age.	Heat per hour.	Heat per hour per square meter.	Basal heat production in 24 hours.	Number of studies.	Number of individuals.	Age.	Heat per hour.	Heat per hour per square meter.	Basal heat production in 24 hours.
		Yrs.	*Calories.*	*Calories.*	*Calories.*			*Yrs.*	*Calories.*	*Calories.*	*Calories.*
2	1	18	80.97	46.27	1,943	5	2	17	56.19	31.83	1,349
5	2	16	73.12	44.43	1,755	8	5	16	56.81	36.96	1,363
6	3	15	60.84	40.13	1,460	4	4	15	60.67	38.34	1,456
5	2	14	45.66	35.16	1,096	1	1	14	51.18	34.18	1,228
6	4	13	59.13	43.18	1,419	3	3	13	61.60	43.08	1,478
2	1	12	47.50	34.93	1,140	11	10	12	58.41	43.89	1,402
6	4	11	56.38	48.10	1,353	11	3	11	62.40	47.73	1,498
4	3	8	40.12	40.39	963	3	2	10	41.15	40.90	988
						4	2	9	45.25	42.62	1,086
						2	2	7	47.55	49.50	1,141

The estimated total heat production in 24 hours for boys and girls of different ages is as follows: For boys $17\frac{2}{12}$ years 3,901 calories, $15\frac{3}{12}$ years 3,096, $13\frac{9}{12}$ years 2,682, $13\frac{9}{12}$ years (underdeveloped) 2,319, 10 years 2,695, and 8 years 2,191 calories, and for girls $17\frac{6}{12}$ years 3,214 calories, $15\frac{9}{12}$ years 2,828, $14\frac{6}{12}$ years 2,606, $12\frac{9}{12}$ years 2,667, $12\frac{9}{12}$ years (underdeveloped) 2,100, 12 years (an individual study) 2,733, $11\frac{8}{12}$ years 2,483, 11 years 2,429, and 9 years 2,223 calories.

In connection with the above investigation, data were also obtained on the actual food consumption of some of the subjects of the metabolism experiments, and from these data and analyses of the cooked foods, calculations were made of the total caloric intake for the different groups. As determined from the average food intake of 20 boys and girls from 12 to 18 years of age, the total food consumption of the day was distributed as follows: Breakfast 1,023 calories, dinner 924, tea 822, and extras (biscuits, buns, fruit, and milk which were supplied between meals and just before bedtime) 403 calories. The proportion of proteins in the diet varied from 15.2 per cent in the junior house to 16.3 per cent in the upper school. Grouped by ages the total food consumption in calories per kilogram of body weight and per square meter of body surface is shown in the following table:

Summary of observations on food consumption of boys and girls.

Boys.				Girls.			
Age.	Fuel value.			Age.	Fuel value.		
	Total.	Per kilogram.	Per square meter.		Total.	Per kilogram.	Per square meter.
	Calories.	*Calories.*	*Calories.*		*Calories.*	*Calories.*	*Calories.*
16–18 years (inclusive)	4,155	71	2,504	16–17 years (inclusive)	3,234	55	1,946
13–15 years (inclusive)	3,044	67	2,106	13–15 years (inclusive)	3,131	66	2,140
10–12 years (inclusive)	2,887	84	2,448	10–12 years (inclusive)	2,806	74	2,234
6–9 years (inclusive)	2,643	105	2,907	5–9 years (inclusive)	2,144	87	2,264

It is concluded that satisfactory allowances for school children of various ages would lie between 2,500 and 3,000 calories for children between the ages

of 6 to 10, 3,000 calories for both boys and girls from 10 to 16, and 3,000 for girls and 4,000 for boys above the age of 16 years.

In a similar study on a smaller scale conducted on the village children, it is noted that the respiratory quotient was higher than in corresponding cases in the boarding school. It is thought possible that this was due to an excess of carbohydrate and a deficiency of protein and fat in the diet.

The influence of the acid and base content of the food on the composition of the urine of growing dogs, J. BORAK (*Biochem. Ztschr., 135 (1923), No. 4–6, pp. 480–492*).—This investigation is based upon previous work of Röse and Berg (E. S. R., 41, p. 558) from which, largely as the result of metabolism experiments on man, the conclusion was drawn that the protein requirement is lower if the diet contains an excess of base over acid than if the acid exceeds the base.

In the present study two dogs were used as subjects and the balance between acids and bases was secured by proper selection of foods without the addition of acid or basic salts. In the first experiment a young dog was kept for 8 days on a ration furnishing an excess of base over acid and then for 8 days on a ration furnishing an excess of acid over base. In the second experiment two dogs from the same litter were fed for the same length of time on rations furnishing an excess of base and an excess of acid, respectively. The food of the basic period consisted of milk 60 gm., potatoes 150, and carrots 100, or soy bean meal 20 gm., and of the acid period tripe 50, rye bread 30, rye meal 10, and sugar 25 gm. Throughout the whole period the urine was collected daily, its amount and reaction determined, and analyses made of total, urea, ammonia, amino acid, and creatinin nitrogen.

A significant difference between the figures obtained for the base and acid periods was a greater gain in weight in the acid than in the basic period. This is considered to be due to a greater water retention as shown by the ratio of urine excreted to the water content of the food in both cases. This is thought to indicate that salts of an acid character are retained in larger amounts than basic salts. It is suggested that the diuretic properties of some vegetables are due to their basic character. Other significant features are considered to be the greater elimination of nitrogen on the acid than on the basic diet (results which confirm the conclusions of Röse and Berg) and the difference in the ratio of urea to ammonia nitrogen on the two diets, the more alkaline the urine the higher being its content in urea and the lower in ammonia nitrogen.

The inorganic phosphorus content of the blood of normal children.—Preliminary communication, G. H. ANDERSON (*Biochem. Jour., 17 (1923), No. 1, pp. 43–48*).—This report deals with certain points of interest in connection with an investigation still in progress on the inorganic phosphorus content of the blood of normal and rachitic children.

The first point investigated was the experimental error involved in the use of the Bell and Doisy method of determining phosphorus in whole blood (E. S. R., 44, p. 613). From 14 consecutive determinations on the same sample of blood, the experimental error was found to lie within 10 per cent.

A study of the question of using whole blood or blood plasma for the determination led to the conclusion that if the blood protein is precipitated immediately and the serum separated from the clot within 40 minutes the same results are obtained, but that considerable error is introduced in the serum determination if the serum has been allowed to stand in contact with the clot for longer periods. On account of this error it is thought best to use whole blood for the determination.

To determine the effect of feeding on the phosphorus content of blood, determinations were made of the inorganic phosphorus in the whole blood of a dog at intervals after fasting from 15 to 24 hours, and of the same dog 1, 2, and 3 hours after ingesting 200 gm. of lean meat. No significant differences in the phosphorus content of the blood were obtained.

Data are reported on the phosphorus content of the whole blood of 23 normal children varying in age from 3 months to 13 years. The range of variation was from 4 to 6.6 mg. per 100 cc., with an average of 4.9 mg.

Calcium content of the blood during pregnancy, S. T. Widdows (*Biochem. Jour., 17 (1923), No. 1, pp. 34–40*).—The author has determined the calcium content of the blood serum of a number of women at intervals during pregnancy, and in some cases within 14 days after confinement. The data reported also include the calcium content of the blood in a number of cases in which there had been miscarriages or stillborn infants.

A comparison of these data with data from the literature on the calcium content of fetuses of different ages shows a distinct tendency of the calcium content of the maternal blood to decrease during the eighth and ninth months of pregnancy, at which time there is a rapid increase in the calcium content of the fetus. "This indicates that at this time attention should be paid to the diet of the mother from the point of view of its calcium content. During the last two months of pregnancy milk (on account of its high percentage of calcium) should be given the mother in a larger amount than that included in the average adult's diet and should be considered a necessary constituent of her diet."

The calcium content of the blood of thyroidectomized animals, M. Parhon (*Endocrinology, 7 (1923), No. 2, pp. 311, 312*).—Data are reported on the calcium content of the blood of three normal sheep and of three others which had been deprived of their thyroid glands a year previously. The calcium content of 1,000 gm. of the fresh blood was 0.071, 0.068, and 0.071 gm., respectively, for the normal, and 0.054, 0.049, and 0.056 gm. for the thyroidectomized animals. The average values for the two groups were 0.07 and 0.053 gm., respectively, or, calculated as grams per 1,000 gm. of dried blood, 0.36 and 0.27 gm., respectively.

A study of the rate of deposition and paths of absorption of strontium in the rat, E. M. Kinney and E. V. McCollum (*Jour. Pharmacol. and Expt. Ther., 21 (1923), No. 3, pp. 165–176, figs. 2*).—This is an extension of a previously noted investigation by Shipley et al. (E. S. R., 48, p. 563), which was concerned primarily with the effect on bone development of the substitution of strontium for calcium in the diet. The present study deals more particularly with the rate of deposition of strontium in rats of different ages and the paths by which it enters the body. The experimental data reported are preceded by a review of the literature on the subject.

That animals are able to deposit strontium in their bones was first shown by analyses of the ash of 3 rats which had been kept for from 53 to 65 days on a diet adequate in every respect except for the substitution of an equimolecular weight of strontium carbonate for the calcium carbonate of the previous diet. The percentages of calcium in the bones of these animals were 31.68, 31.33, and 31.61, and of strontium 7.25, 7.48, and 7.46 per cent, respectively.

In order to determine the rate at which strontium is deposited, young rats were placed on the diet and killed at 3-day intervals. The percentages of calcium and strontium in the ash of the bones showed that strontium is deposited very rapidly, and that as the strontium increases the calcium tends to decrease. In mature animals similar changes in the bone constituents took place, but not so rapidly as in the young animals. Data are also presented

showing that strontium is deposited within a day after its addition to the diet, that the presence of a sufficient amount of calcium in the diet does not prevent the deposition of strontium, and that strontium can enter the body through the placenta and through the milk of the mother. It is emphasized, however, that strontium can in no way replace calcium physiologically.

Further contributions to the knowledge of foodstuffs with specific action, XXIII–XXV (*Pflüger's Arch. Physiol., 198 (1923), No. 2, pp. 165–190, figs. 22*).—In continuation of the series of studies previously noted (E. S. R., 49, p. 358), three papers are presented.

XXIII. *Comparative experiments on the behavior toward a scorbutic ration of guinea pigs with and without the thyroid gland*, E. Abderhalden (pp. 164–168).—This is the first part of a general investigation of the behavior of animals lacking various organs toward the progress of deficiency disease. In the present study observations were made on the effect of removal of the thyroid gland upon the progress of scurvy in guinea pigs. No consistent difference could be noted in the behavior of the test and control animals. In some of the test animals scurvy appeared earlier than in the controls, while in others the reverse was true. On the whole the scurvy seemed to be more severe in the test than in the control animals.

XXIV. *Further studies on the character of the disturbances in cellular metabolism of polyneuritic pigeons*, Abderhalden and E. Wertheimer (pp. 169–178).—The muscle tissue and liver of normal pigeons and of pigeons fed exclusively on polished rice and killed in the state of active polyneuritis were analyzed for nitrogen, sulphur, and carbon. No significant differences could be detected in the ratio of nitrogen to sulphur to carbon in the two groups.

The tissues of normal and polyneuritic pigeons were then tested for their ability to reduce cystin to cystein. The method consisted in suspending 3 gm. of finely divided fresh muscle tissue in 5 cc. of a phosphate solution of pH = 9 and after allowing it to stand for 15 hours at room temperature, determining the cystein formed. Controls were run with muscle tissue without added cystin and with muscle tissue plus cystin, plus 0.1 gm. dried yeast. In the tissues of normal pigeons 0.6 mg. of cystein was recovered both in the presence and in the absence of dried yeast. In the tissues of polyneuritic pigeons the amount of cystein recovered varied from 0 to 0.3 mg. when no yeast was added and from 0.2 to 0.7 mg. in the presence of yeast. These results are considered of significance in pointing to a loss in the reducing properties of the cells in polyneuritic pigeons.

XXV. *The influence of bromobenzol on normal and rice-fed pigeons*, Abderhalden (pp. 179–190).—The intramuscular injection of bromobenzol was found to lower the respiration and temperature of pigeons on a polished rice diet to a much greater extent than that of normal pigeons.

The effect of a restricted diet, IV, V, J. R. Slonaker and T. A. Card (*Amer. Jour. Physiol., 64 (1923), No. 2, pp. 203–209, 297–310, fig. 1*).—Two papers are presented, continuing the investigation previously noted (E. S. R., 49, p. 458).

IV. *On the age of greatest productivity.*—Observations are reported on the effect of the previous restricted diet on the age of greatest productivity.

The greatest number of litters among the omnivorous feeders was 9 and the average number of litters of each group on the restricted diet 3. The interval between the litters in the controls was fairly constant, ranging between 1¾ and 2½ months, while in the restricted feeders it showed marked variations, ranging between 3 weeks and 4½ months. In the controls the young individuals had smaller litters than the older ones, while among the restricted feeders variable results were obtained.

Group 5 was the only group on the restricted diet in which there were more more than 3 litters. Although the animals had practically ceased to breed at the third litter, they were so stimulated by the addition of animal protein to the diet that they were able after a considerable period to reproduce again, the litters in this case being larger than any on the restricted diet. "The marked delay in the birth of the fourth litter emphasizes the statement that the effect of a change in diet is often not manifested for some time, sometimes representing a considerable portion of the life span of the animal."

V. *On mortality, cannibalism, and the sex ratio.*—In general, the mortality of the young of the first litter of the omnivorous stock placed on the restricted diet was increased. With succeeding litters the mortality became less, thus indicating a possible adjustment to the inadequate diet, resulting in more resistant or stronger young. All of the young of the second-generation matings of the restricted feeders died.

In the control rats there was an increase of cannibalism as the parents grew older, and this was also true in one group of restricted feeders whose parents were from the restricted stock. A sudden change from the omnivorous diet to the restricted diet caused a marked increase in cannibalism in the first litters, with a gradual adjustment in successive litters.

The restricted diet appeared to reduce the proportion of males to females. The average sex ratio in the control rats was 108 males to 100 females and in the restricted groups from 84 to 97 males to 100 females.

Does the lack of vitamins act specifically in arresting oxidation? K. Morinaka (*Biochem. Ztschr., 135 (1923), No. 4–6, pp. 603–609*).—The conflicting literature on the effect of lack of vitamins on oxygen consumption in the body is reviewed briefly, and data are reported on an attempt to answer the question by testing the effect on oxidation in a dog on a vitamin-free diet of an easily oxidizable substance, sodium acetate.

The feeding or subcutaneous injection of 3 or 4 gm. of sodium acetate was found not to alter to any significant extent the content of volatile fatty acids in the urine, thus indicating that there was no loss in oxidative processes. Further evidence on this point was secured by determining the total and neutral sulphur content of dogs on a vitamin-deficient diet. Again no evidence was obtained of any disturbance in the metabolism of the difficultly-oxidizable sulphur portion of the protein molecule.

The author concludes that, in spite of a decrease in total oxidation following loss in body weight, the total exchange must be increased in vitamin deficiency, but that the end product may not be carbon dioxid. It is suggested that carbon may be eliminated in increased amounts through the urine or that perhaps the disintegration stops at an intermediate stage.

The formation of vitamin A in plant tissues, II, K. H. Coward (*Biochem. Jour., 17 (1923), No. 1, pp. 134–144, pl. 1, figs. 3*).—In the first part of this continuation of the investigation previously noted (E. S. R., 46, p. 356), the tests on the vitamin A content of etiolated shoots were repeated on account of the contention of Wilson (E. S. R., 47, p. 368) that etiolated wheat sprouts are as effective as green sprouts as a source of vitamin A and that consequently photosynthesis is not necessary for the production of vitamin A.

Using the method employed in the previous study, 6 rats whose weights had become stationary on the basal diet were each fed daily for a period of at least 3 weeks a single etiolated shoot of wheat as a supplement to the basal ration, while 3 controls were fed a single green shoot of the same age. As further controls, 4 rats were each given as the sole source of vitamin A one ungerminated wheat seed. With the ungerminated seeds no growth resulted and 3 of the animals declined in weight and died. With the etiolated shoots

fair growth was obtained in 1, slight growth in 2, and no growth in 3 cases. With green shoots normal growth was secured in every case. Similar results were obtained with green and etiolated shoots of yellow and white corn. "Thus, while it would be impossible to deny the existence of very small quantities of vitamin A in etiolated seedlings, it would appear to be established that the amount is increased considerably by exposing the seedlings to sunlight."

In other tests reported in this paper evidence was obtained that electric light is also effective in increasing the rate of formation of vitamin A, but that ultraviolet light does not affect it; that the process can be carried on in the absence of carbon dioxid and oxygen in the surrounding atmosphere; that it is independent of the presence of chlorophyll in the plant; that the presence of chloroform in the atmosphere prevents the formation of the vitamin; and that the almost complete absence of calcium salts from the nutrient solution of a water culture of Tradescantia does not prevent the formation of the vitamin in the leaves of the plant.

The association of vitamin A with the lipochromes of plant tissues, K. H. Coward (*Biochem. Jour., 17 (1923), No. 1, pp. 145–156, fig. 1*).—The literature on the possible association of vitamin A with lipochrome pigments is reviewed, and the results are reported of an examination of the lipochrome content of all plant tissues used in the preceding investigation and of a comparison of the lipochrome content, growth-promoting power, and calcium content of all available lipochrome-containing tissues, these being as varied as possible from a botanical point of view.

The comparison between the absolute amounts of lipochrome present in the shoots which did not promote growth and those which did showed that lipochromes are present in many of the tissues before the appearance of the vitamins, and that the activity of the tissue as a source of vitamin A is not measured by its lipochrome content. Further evidence is furnished, however, of an association of some sort between the lipochromes and vitamin A in plant tissues. The presence of vitamin A associated with the presence of lipochromes was noted in tomato pulp, cucumber skin, yellow iris flower, orange juice, red and yellow capsicum fruit, and the calyx of the ripened fruit of the winter cherry. Absence of vitamin A was found to be associated with absence of lipochromes in four varieties of mangels, one variety of swedes, the fleshy part of the cucumber (slight amount of vitamin A), cauliflower, and the corollas of the ray florets of the Shasta daisy and of a purple aster. No example has been found of the association of vitamin A with a yellow water-soluble pigment, and two or three cases have been noted in which lipochrome-containing materials have shown no evidence of vitamin A. Among these are two varieties of brown seaweed. It is suggested in explanation of this that in these varieties the light may be adequate for carbon assimilation, but not of the right quality for the formation of vitamin A.

In an effort to explain the formation of vitamin A in tissues not exposed to light such as carrots and sweet potatoes, the suggestion is advanced that the vitamin is carried down into the root from the green leaves. Although this could not be demonstrated, it was found that the vitamin in the root could be transported upward into the leaves.

The author concludes that "the chief point in the formation of the vitamin which is apparent from these experiments is that some lipochrome (generally carotin) is always associated with the vitamin in plant tissues, and that where carotin is found, particularly carotin exposed to sunlight, there the vitamin may be expected to be present also."

Information on the vitamin A content of various foods is afforded by the following figures taken from the reported data: Good growth of the experi-

mental rats was obtained when the sole source of vitamin A was 0.5 gm. of tomato pulp, 1 gm. of cucumber skin, 10 cc. of orange juice, or 1 gm. of red or yellow capsicum. No or only slight growth was obtained with 1 gm. of mangels, swedes, cucumber, and cauliflower, no growth with 0.01 gm. of turnip, and fairly good growth with 0.01 gm. of carrots.

The effects of atropinization on the phenomena of deficiency disease in pigeons on a polished rice diet, F. ARLOING and A. DUFOURT (*Compt. Rend. Soc. Biol.* [*Paris*], *88* (*1923*), *No. 11, pp. 774, 775*).—Three series of experiments are reported in which a study was made of the effects of atropin on pigeons in different conditions. The atropin was injected subcutaneously every other day in varying doses and with the following results:

The repeated injections of atropin in from 3 to 6 mg. doses hastened the appearance of polyneuritis in pigeons fed on polished rice. On continuing the injections of atropin but restoring the pigeons to normal diet, the symptoms of polyneuritis disappeared promptly. Preliminary atropinization did not hasten the onset of polyneuritis when the pigeons were placed on polished rice after the administration of atropin had been stopped.

The action of pilocarpin on experimental deficiency disease in pigeons, F. ARLOING and A. DUFOURT (*Compt. Rend. Soc. Biol.* [*Paris*], *88* (*1923*), *No. 11, pp. 775, 776*).—A study similar to the above is reported for pilocarpin with similar results. In doses of from 3.5 to 5 mg. every other day pilocarpin appeared to hasten the onset of polyneuritis in pigeons on polished rice, but not to prevent the rapid cure of these symptoms following a change to normal diet, nor to have any effect when injected prior to the change to the deficient diet.

Intoxication and deficiency disease.—The effects of adrenalin on experimental deficiency disease in pigeons, F. ARLOING and A. DUFOURT (*Compt. Rend. Soc. Biol.* [*Paris*], *88* (*1923*), *No. 13, pp. 1037, 1038*).—The experiments with pilocarpin and atropin have been repeated with adrenalin, this substance being administered intramuscularly every two or three days in doses of 4 drops of 1:1,000 solution of adrenalin hydrochlorid in 1 cc. of distilled water.

The administration of this small amount of adrenalin hastened the onset of polyneuritis.

The prevention of simple goiter, O. P. KIMBALL (*Pub. Health Rpts.* [*U. S.*], *38* (*1923*), *No. 17, pp. 877–885, figs. 5*).—A brief account is given of the remarkable results which have been obtained in endemic goiter districts in this country and in Switzerland in the prevention of goiter in school children by the weekly administration of small amounts of iodin either in the form of inorganic or organic iodids. In Switzerland the iodin is given in the form of chocolate tablets each containing 5 mg. of an organic iodid. It is stated that since this preventive treatment has been instituted the incidence of goiter among all the school children of the Canton of St. Gall has decreased from 87.6 per cent in January, 1918, to 13.1 per cent in January, 1922.

ANIMAL PRODUCTION.

The effect of selection upon a Mendelian ratio, C. C. LITTLE and E. E. JONES (*Genetics, 8* (*1923*), *No. 1, pp. 1–26, pl. 1, figs. 19*).—Experiments are reported from the University of Maine to study the possibility of modifying a Mendelian ratio by selection as King had modified the sex ratio in rats (E. S. R., 41, p. 864).

The experiments were carried on with *Drosophila melanogaster* and the characters used in the study were normal eye and eyeless. Under ordinary conditions eyeless flies are less viable than normal flies. The average ratio of the two types produced by crossing a heterozygous normal with an eyeless

was 144±2.1 normal to 100 eyeless. The plan of the test consisted in selecting four breeding lines for an excess of normals and in four other lines for an excess of eyeless individuals, one line in each group having the same ancestry. The lines were bred for from 3 to 14 generations, and the average ratios of those selected for a low production in normals was 121.64±0.64 and in the high selection group 140.65±0.55 to 100 eyeless. Some of the ratios in succeeding generations were variable, being 117.5±4.3 in the eleventh generation of one high selected line and 1,572.2±5.11 to 100 eyeless in the twelfth generation of the same line.

The authors concluded that distinct progress had been made in the selection for high ratio of normals in one line and for a low ratio in another.

Ö. Winge's paper on The Interaction Between Two Closely Linked Lethals in Drosophila as the Cause of the Apparent Constancy of the Mutant "Spread."—A necessary rectification, O. L. Mohr (*Genetica [The Hague], 4 (1922), No. 5–6, pp. 457–461*).—Attention is called to a mistake in the paper of Winge (E. S. R., 48, p. 469), in which the character referred to as "spread" should have been "dichaete." The correction is also acknowledged by Winge, in which he states that in every place where the word "spread" is used the word "dichaete" should be substituted.

The occurrence and hereditary behavior of two new dominant mutations in an inbred strain of Drosophila melanogaster, M. C. Mann (*Genetics, 8 (1923), No. 1, pp. 27–36*).—Two new mutations occurring in an inbred strain of *D. melanogaster* at the University of California and their methods of inheritance are described.

One mutation looked like a sex-linked dominant character notch, but differed genetically from it. This mutant was found to be heterozygous for this condition, which was caused by a dominant factor, N_2, located in the second chromosome. Notch flies occurred only during the first three days of hatching in other breeding tests, the explanation being that cultural conditions or lack of viability have something to do with its production.

The other mutation was the presence of strong lateral bristles on the sides of the thorax, due to a factor, B_r, located at 19 in the second chromosome. B_r is lethal when homozygous, but otherwise exhibits normal fertility and viability.

The index cephalicus, G. P. Frets (*Genetica [The Hague], 4 (1922), No. 5–6, pp. 481–534, figs. 8*).—A statistical study has been made of the cephalic indexes of 1,545 men and 2,057 women that have visited the inmates of the Maasoord Asylum at Rotterdam. The head length, breadth, and index and coefficients of correlations between them are tabulated for men and women together and separately, for brothers and sisters, and for boys and girls. Comparisons are made with similar data reported by other investigators.

Sunflower investigations, R. E. Neidig and R. S. Snyder (*Jour. Agr. Research [U. S.], 24 (1923), No. 9, pp. 769–780*).—The changes in the composition of the leaves, stalks, and flowers of the sunflower plant during different stages of growth and when planted different distances apart were studied on the 1920 and 1921 crops at the Idaho Experiment Station. In making the investigation some of the plants were thinned to 36 in. apart, whereas others were left from 4 to 8 in. apart in 1920, and in 1921 single plants were thinned to 8 and 24 in., with hills of 1, 2, 3, and 4 stalks 42 in. apart. The stages of growth at which the analyses were made were at the time of budding of the flower, when the first flower was 3 in. in diameter, when the seeds were not quite to the dough stage, when the seeds were well into the dough stage and rays were beginning to fall, and when the seeds of the first

flower were quite hard. Silage made from the different cuttings was preserved in milk bottles and analyzed after fermentation.

In discussing the results, the authors state that there is little difference in the percentage of dry matter in the sunflowers planted different distances apart, but the increase in dry matter with maturity is more gradual and slightly greater in the plants 36 in. apart. The protein content was consistently higher in the 36-in. plantings and increased with maturity in 1920, but in 1921 the protein content decreased with maturity, and the system of planting seemed to have very little effect. The crude fiber content did not increase markedly throughout the stages of maturity studied, and it really decreased in the final cutting. The closer spaced plants seemed to contain more fiber than those growing further apart. The ether extract content was somewhat variable, but in 1921 the content was higher in the last two stages of maturity. In 1920 the plants 36 in. apart were found to produce larger and more mature flowers, which thus made a higher fat content. The acidity was highest in silage made from the more mature sunflowers. The total acids in 100 gm. of wet silage, however, varied only from 2 to 3 gm. in 1920. The sunflowers cut at the early stages of growth would not be satisfactory for the practical production of silage because of their high water content.

A study of the yields produced when the sunflowers were cut at different stages of maturity and when planted different distances apart indicated that the yields seemed to depend on seasonal conditions.

Sweet clover investigations, R. E. Neidig and R. S. Snyder (*Jour. Agr. Research [U. S.], 24 (1923), No. 9, pp. 795–799*).—Chemical analyses of samples of yellow (*Melilotus officinalis*) and white (*M. alba*) sweet clover cut at different stages of growth are reported from the Idaho Experiment Station. The stages of cutting the yellow sweet clover were (1) when the plant was in blossom, having a height of 37 in., and (2) when the plant was partly in blossom and partly in seed. The white clover was sampled (1) before it was in blossom, at a height of 49 in., (2) when beginning to blossom, and (3) when in full bloom with a few seeds formed.

Samples of silage made from the clovers at the different cuttings and allowed to ferment one week in milk bottles without access to air were also analyzed. The following table gives the analyses of the material on a fresh wet basis:

Composition of sweet clover and sweet clover silage.

Variety.	Description.	Stage of growth.	Date of cutting, 1920.	Height.	Acre yield.	Moisture.	Crude protein.	Ether extract.	Crude fiber.	N-free extract.	Ash.	Total acidity of silage.
				In.	*Tons.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
Yellow..	Fresh..	1	July 2	37	11.7	73.50	5.56	0.85	6.80	10.30	2.99	.....
Do..	...do....	2	July 13	37	10.9	69.50	5.06	.63	9.99	11.92	2.90	.....
Do..	Silage..	1	July 2	.....	.....	75.60	4.50	.63	7.48	9.19	2.60	1.781
Do..	...do....	2	July 13	.....	.....	72.40	4.38	.49	9.31	10.64	2.78	1.601
White...	Fresh..	1	July 2	49	21.0	75.40	5.38	.45	7.59	8.53	2.65	.....
Do..	...do....	2	July 14	60	14.0	73.40	5.06	.55	9.01	9.82	2.16	.....
Do..	...do....	3	July 22	60	16.8	69.40	4.25	.57	11.64	11.80	2.34	.....
Do..	Silage..	1	July 2	.....	.....	77.16	3.75	.51	7.83	8.66	2.09	1.881
Do..	...do....	2	July 14	.....	.....	75.32	3.69	.23	8.52	10.25	1.99	1.604
Do..	...do....	3	July 22	.....	.....	70.64	4.06	.47	10.75	11.92	2.16	1.997

Commercial feeding stuffs, E. G. Proulx et al. (*Indiana Sta. Bul. 268 (1923), pp. 23, fig. 1*).—This is a report of the inspection of feeding stuffs in Indiana for the calendar year 1922. It includes a general review of the work

and gives the amount and value of feeding stuffs sold in the State. The low quality of some brands of digester tankage is briefly discussed, and a wider usage of soy bean meal in rations for stock is suggested.

Modern abattoir practice and methods of slaughtering, H. WILLIAMS (*Jour. Roy. Soc. Arts, 71 (1923), No. 3682, pp. 515–543, figs. 26*).—The methods of slaughtering meat animals at the more modern abattoirs of Europe, Australia, and America are described.

Specialized zootechny.—I, The hygiene and nutrition of young animals, E. CUROT (*Zootechnie Spéciale.—I, Hygiène et Alimentation du Jeune Bétail. Paris: Libr. Sciences Agricoles, 1923, vol. 1, pp. X+456, figs. 33*).—This volume deals with the hygiene and nutrition of young animals.

[Animal nutrition experiments at the Iowa Station] (*Iowa Sta. Rpt. 1922, pp. 36, 37*).—Continued acid feeding (E. S. R., 47, p. 375) for three generations in swine has apparently done no material damage. It is stated that swine may be fed rations high in protein which produce a certain amount of acid in the body provided the ration is satisfactory in other essentials, particularly minerals and vitamins. In other experiments it has been demonstrated that a vitamin deficiency in the ration affects the suckling young of rabbits and swine. The difference between the vitamin content of white and yellow corn has been shown to be of less importance for fattening swine during the later growing and fattening period than during the breeding and early growing periods.

[Experiments with beef cattle at the Idaho Station] (*Idaho Sta. Bul. 131 (1923), p. 28*).—To compare sweet clover with mixed blue grass and timothy pasture, 2 Shorthorn heifers were placed on 2 acres of each kind from July 11 to October 3, 1922. The heifers on the mixed pasture made average daily gains of 1.07 lbs. per head, whereas those on the sweet clover pasture gained 0.89 lb. per head.

Fattening cattle (*Nebraska Sta. Rpt. 1922, pp. 15, 16*).—In continuing the study of the effect of age on the economy of gain in beef cattle (E. S. R., 47, p. 773), lots of 10 3-year-olds, 2-year-olds, yearlings, and calves were fed on a ration of shelled corn and alfalfa for 200 days. The average initial weights of the animals at the start of the test in the different lots were, respectively, 1,215, 854, 635, and 399 lbs., and the respective gains per steer 522, 406, 403, and 434 lbs. The calculated costs per 100 lbs. of gain in the 4 lots were, respectively, $9.95, $9.83, $7.43, and $5.33.

In another test 50 steers averaging 900 lbs. in weight were divided into 5 lots for comparing different rations. All lots received corn and alfalfa hay and the following additional feeds: Lot 2 oil meal, lot 3 corn silage, lot 4 oil meal and corn silage, and lot 5 molasses meal and corn silage. The test lasted 150 days, during which time the lots made respective gains per head of 346, 339, 329, 318, and 319 lbs. at costs per 100 lbs. of gain of $8.08, $9.68, $7.84, $9.46, and $9.21, respectively.

An additional lot of 10 head of rather poor steers averaging 925 lbs. were fed at the same time on corn and alfalfa and made average gains of 293 lbs. per steer.

Wintering and summer fattening of cattle in western North Carolina, R. S. CURTIS (*North Carolina Sta. Rpt. 1922, pp. 52, 53; also in N. C. Dept. Agr. Bien. Rpt., 1921–22, pp. 44, 45*).—Six lots of steers were wintered for 112 days on the following average daily rations: Lot 1, 10 lbs. of hay, 1 lb. of cottonseed meal, and 1 lb. of crushed corn-and-cob meal; lot 2, 5 lbs. of hay and straw mixed, 15 lbs. of corn silage, and 1 lb. of cottonseed meal; lot 3, 5 lbs. of hay and straw mixed and 15 lbs. of corn silage; lots 4 and 5, 10 lbs. of hay, 1 lb. of cottonseed meal, and 1 lb. of crushed corn-and-cob meal; and lot 6,

2 lbs. of cottonseed meal and 12 lbs. of cottonseed hulls. The different lots made the following losses, respectively: 67, 51, 59, 54, 79, and 75 lbs.

At the conclusion of the wintering period the steers were placed on pasture for 140 days, during which time the different lots made respective daily gains of 2.39, 2.3, 2.59, 2.39, 2.82 and 2.5 lbs. The author concludes that corn silage, cottonseed meal, and cottonseed hulls in winter rations of steers are not detrimental to gains made the following summer.

Roughages for fattening two-year-old steers (*Iowa Sta. Rpt. 1922, p. 19*).—In comparing different roughages in the rations for fattening beef cattle, it was found that the standard Corn Belt ration consisting of shelled corn, cottonseed meal, corn silage, alfalfa hay, and block salt was superior to rations containing other roughages. Corn silage, alfalfa hay, red clover hay, and mixed red clover and timothy hay showed up well, but corn fodder, timothy hay, and oat straw as lone roughages, though properly supplemented, made poor showings.

Steer feeding trial, 1921–22, H. W. Rogers (*Ohio Sta. Bul. 361 (1922), pp. 552, 553*).—Two lots of 10 steers each were selected for a 133-day feeding test for comparing rations consisting of 2 lbs. of cottonseed meal per day and corn silage and clover hay according to appetite, with and without ear corn fed in amounts equivalent to 7.5 lbs. of shelled corn per day. The steers receiving the ear corn made daily gains of 2.18 lbs., as compared with 2.14 lbs. for the steers receiving no corn. The lot receiving the ear corn required per 100 lbs. of gain 344 lbs. of shelled corn, 92 lbs. of cottonseed meal, 35 lbs. of clover hay, and 1,671 lbs. of corn silage. The other lot required 93 lbs. of cottonseed meal, 41 lbs. of clover hay, and 2,330 lbs. of corn silage per 100 lbs. of gain.

Ten hogs followed the steers when ear corn was fed and 7 hogs followed the steers in the other lot. Because of the extra amount of corn picked up in the lot where ear corn was fed, the profits per steer over feed cost including hog profits were $21.55, and only $17.04 in the other lot.

[Sheep experiments at the Iowa Station] (*Iowa Sta. Rpt. 1922, pp. 19, 20*).—The results of two experiments with sheep are reported.

Soy bean hay whole v. ground for fattening lambs.—Whole and ground soy bean hay were compared with clover hay for fattening lambs. The rest of the rations consisted of shelled corn, cottonseed meal, corn silage, and block salt. The gains of all lots varied from 0.45 to 0.51 lb. per lamb per day. Two lots receiving whole soy bean hay outsold the other lots, but two lots receiving ground soy bean hay did not do so well. The lot making the poorest showing received ground hay mixed with the grain. The largest profits were made in the whole soy bean hay lot.

Wintering the pregnant ewe.—The experiment in feeding potassium chlorid was continued in practically the same manner as was previously noted with potassium carbonate (E. S. R., 47, p. 775). Similar results were obtained except that the potassium chlorid feeding had no effect on the salt consumption.

Effect of cottonseed meal upon the reproductive qualities of ewes, R. S. Curtis (*North Carolina Sta. Rpt. 1922, p. 53*).—Experiments at the station and the Piedmont Substation show that cottonseed meal may be fed without injury in amounts of from 0.75 to 1 lb. daily to ewes, depending on their size.

Lamb feeding experiment (*Nebraska Sta. Rpt. 1922, pp. 29, 30*).—In continuing the study of different rations for fattening lambs at the Scottsbluff Substation (E. S. R., 47, p. 775), the efficiency of various supplementary feeds to alfalfa hay has been investigated with 12 lots of 25 lambs, each averaging about 44 lbs. per lamb. The test lasted 120 days. General results indicate that corn produced more and cheaper gains than dried beet pulp, and that cottonseed

cake when fed with corn and dried beet pulp increased the gains and lowered the cost. Beet tops were slightly superior to corn silage in amount and economy of gain. The most economical results occurred in the lot receiving alfalfa, corn, and beet tops, whereas the least economical results were obtained in the lot receiving alfalfa and dried beet pulp.

Rations for fattening lambs (*Nebraska Sta. Rpt. 1922, pp. 16, 17*).—In continuing the study of comparative rations for fattening lambs (E. S. R., 47, p. 775), 6 lots of 30 lambs each averaging about 56 lbs. in weight were selected for a 92-day test. All lots received corn and alfalfa hay with the following additional supplements: Lot 2 corn silage, lot 3 linseed oil meal, lot 4 molasses meal and corn silage, lot 5 linseed oil meal, and lot 6 linseed oil meal and corn silage. The average gains per head made during the test by lots 1 to 6 were, respectively, 35.6, 35, 38.6, 34.7, 39.4, and 37.1 lbs. at calculated costs per 100 lbs. of gain of $4, $4.02, $4.03, $4.26, $4.46, and $4.49, respectively.

Soy beans for fattening lambs, W. G. Kammlade (*Breeder's Gaz., 83 (1923), No. 25, p. 848*).—An experiment in fattening lambs on grain rations consisting of 4 parts of shelled corn and 1 part of whole soy beans, ground soy beans, soy bean oil meal, or linseed oil meal, with soy bean straw as a roughage, is reported from the Illinois Experiment Station. Each lot consisted of 25 lambs averaging 58 to 59.9 lbs. at the beginning of the test.

During the 95-day feeding period, the lot receiving the whole soy beans made average daily gains of 0.26 lb., that on ground soy beans 0.25 lb., soy bean oil meal 0.27 lb., and linseed oil meal 0.27 lb. Though no significant differences resulted from the use of the different supplements, the author states that the whole and ground soy beans were less palatable than soy bean oil meal or linseed oil meal. Much of the soy bean straw was refused as feed, but its use is recommended because of its low value.

Swine feeding [at the Idaho Station] (*Idaho Sta. Bul. 131 (1923), p. 27*).—In continuing the comparative study of peas and tankage as protein supplements for pigs in dry lot (E. S. R., 47, p. 776), 4 lots of 9 pigs each averaging about 78 lbs. were fed for 76 days on the following mixtures: Lot 1 75 lbs. rolled barley and 8 lbs. tankage, lot 2 2 lbs. rolled barley and 1 lb. cracked peas, and in lots 3 and 4 corn replaced the barley in the mixtures fed to lots 1 and 2, respectively. All lots made similar gains during the first 6 weeks, but after that time the pigs in the lots receiving peas began to gain more slowly, and they were very unthrifty. The amounts of feed requided per 100 lbs. of gain were for lot 1 435.2 lbs., lot 2 535.4, lot 3 399, and lot 4 476.8 lbs.

[Swine experiments at the Iowa Station] (*Iowa Sta. Rpt. 1922, pp. 20–25, 61, 62*).—In addition to experiments previously noted (E. S. R., 47, p. 776), the following experiments in swine feeding are reported:

Saving the orphan pigs.—In additional experiments in feeding yeast and yeast foam to pigs (E. S. R., 47, p. 777), the pigs receiving the additional vitamin B made the best gains.

Feeding minerals to fattening pigs in dry lot.—In comparing different minerals for fattening pigs in dry lot, 10 lots of pigs were selected and self-fed on shelled corn plus a supplemental mixture of blood meal 40 parts, corn oil cake 30 parts, linseed oil meal 20 parts, and peanut meal 10 parts. The mixture giving the best results consisted of salt, ground limestone, and bone meal, equal parts. This was fed at the rate of 9 lbs. of the mineral mixture with 100 lbs. of the supplemental balance mixture.

Cottonseed meal for dry lot pig feeding.—Seven lots of 7 pigs each were fed from an average weight of about 55 lbs. to a weight of 225 lbs. per head in dry lot to test the possibility of using cottonseed meal as a supplemental feed for hogs. All lots were self-fed shelled corn, and the cottonseed meal was mixed

with blood meal in the proportions of 4:1 and self-fed. Calcium chlorid had been added to the cottonseed meal of 1 lot (No. 6) during the process of manufacture. The other lots received various mineral mixtures. "Cottonseed meal feeding in this single experiment, comprising as it did about 15 to 20 per cent of a well balanced ration, and fed for a period of almost four months in conjunction with shelled corn and blood meal (with and without minerals), was attended with good results from the standpoints of health, feed consumption or appetite, gains made, and feed requirement." The best gains were made when the mineral mixtures were fed, and the mineral mixtures producing the best showing consisted of equal parts of finely ground limestone, common salt, and bone meal, with 1 per cent of potassium iodid added. No advantage was observed in the case of the lot receiving the cottonseed meal treated with calcium chlorid.

Type tests of swine.—A continuation of the studies of the rate of gains of hogs of the big, medium, and small types has given results similar to those previously noted (E. S. R., 47 p. 779). The big type hogs made the most rapid gains at all times, followed in order by the medium and small type pigs. The highest dressing percentages were obtained with the small type pigs, but their carcasses were too fat according to present standards.

[Swine experiments in North Carolina], E. H. Hostetler (*North Carolina Sta. Rpt. 1922, pp. 39, 41, 42; also in N. C. Dept. Agr. Bien. Rpt., 1921–22, pp. 32, 33, 36*).—In determining whether sufficient fish meal might be consumed by a pig to taint the meat, 2 pigs received fish meal in separate compartments of self-feeders and a third pig received a mixture of 9 parts corn and 1 part fish meal. The pigs were fed for 114, 43, and 118 days, respectively, during which time they consumed 19, 15, and 82 lbs. of fish meal, but no fishy taste was noticed in any of the meat when the pigs were slaughtered.

In soft pork studies at the Edgecombe Substation, it was found that 1 acre of peanuts produced 151.5 lbs. of pork, but the pork was soft. An 8 weeks' finishing period on corn and tankage was not sufficient to harden the fat of pigs that had grazed 8 weeks on peanuts.

In a test at the Black Land Substation, two lots of 67 and 68 pigs, respectively, were fed for 70 days on shelled corn, with a tankage supplement in one lot and a fish meal supplement in the other lot. The lot receiving fish meal gained 1.16 lbs. per day and the other lot 0.96 lb. By feeding corn to hogs it returned $1.10 per bushel, whereas the prevailing market price was 65 cts.

Sixteen spring pigs receiving a 2 per cent ration consisting of 9 parts corn and 1 part tankage and grazing on one-half acre of soy beans and one-half acre of drying cowpeas at the Iredell Substation made gains of 0.59 lb. per day.

Rations for fattening hogs (*Nebraska Sta. Rpt. 1922, pp. 17, 18*).—In comparing different rations for fattening hogs, the following amounts of feed were required to produce 100 lbs. of gain: Lot 1, 1,056 lbs. of corn; lot 2, 459 lbs. of corn and 52 lbs. of tankage; lot 3, 495 lbs. of corn, 51 lbs. of tankage, and 52 lbs. of alfalfa hay; lot 4, 378 lbs. of corn and 63 lbs. of alfalfa hay; lot 5, 366 lbs. of corn, 33 lbs. of tankage, and 101 lbs. of wheat shorts; and lot 6, 442 lbs. of corn and 23 lbs of tankage.

Yellow corn v. white corn for feeding pigs (*Nebraska Sta. Rpt. 1922, p. 26*).—Using 6 lots of 10 pigs each for comparing the feeding value of yellow and white corn when additional supplements were furnished in self-feeders, average daily gains of 1.28 lbs. were produced with both types at the North Platte Substation. It is stated that the equal results were probably due to the supplements furnishing sufficient of the elements that were deficient in the white corn.

The correlation between the time of beginning and the time of cessation of laying in the first and second laying year in the domestic fowl, J. A. HARRIS and H. R. LEWIS (*Genetics, 8 (1923), No. 1, pp. 37–74, figs. 19*).—A statistical study is reported of the relationship between the time of beginning and cessation of laying during the first and second year by the 441 White Leghorns which laid in both years of the Vineland International Egg-Laying Contest. Other studies of these data have been previously noted (E. S. R., 48, p. 667).

The time of starting laying has been expressed as the number of days after November 1 when the first egg was laid, and the cessation of laying as the number of days before November 1 when the last egg was laid by each bird. Frequency distributions showed that 212 birds started laying in the first 5 days and 344 birds started laying in the first 20 days of their first laying year. The times of cessation of laying in the first year and beginning of laying in the second year were bimodal, and the distributions were somewhat similar in each case. The time of cessation of laying in the second year was so variably distributed that its modes could not be accurately determined.

Because of the variations in the frequency curves, constants were calculated both on the basis of total population and after certain classes had been eliminated, but the results were similar in most cases. The symbols b_1 and b_2 have been used to designate the time of beginning laying in the first and second years, respectively, and c_1 and c_2 as the time of cessation of laying during the first and second years. The calculated statistical constants based on the total population were $b_1=20.06$, $\sigma_{b1}=29.43$, $V_{b1}=146.7$, $b_2=66.51$, $\sigma_{b2}=38.03$, $V_{b2}=57.02$, $c_1=44.19$, $\sigma_{c1}=30.43$, $V_{c1}=68.9$, $c_2=49.41$, $\sigma_{c2}=31.8$, and $V_{c2}=64.4$. The coefficients of correlation calculated on the total populations were $r_{b_1b_2}=0.2295\pm0.0304$, $r_{c1c2}=0.5028\pm0.0240$, $r_{b1c1}=0.2439\pm0.0302$, $r_{b2c2}=0.3969\pm0.0271$, $r_{c1b2}=0.5007\pm0.0241$, and $r_{b1c2}=0.1561\pm0.0313$. The results indicate that the time of beginning laying is closely correlated with the persistency of laying during the same year, but the relationships between the different years, though correlation was indicated in most cases, are apparently affected by other factors.

The possibility of the maturity of the birds affecting the results is discussed, and it is concluded on the basis of the uniformity in the time of starting and the relationship with the time of cessation during the first year that the maturity of the birds must be nearly uniform. Regression equations for the constants during the two years were also calculated.

A method for distinguishing the sex of young chicks, L. C. DUNN (*Connecticut Storrs Sta. Bul. 113 (1923), pp. 244–280, figs. 8*).—In studying the practical use of methods of determining the sex of chicks at birth (E. S. R., 47, p. 378) by crossing breeds, possessing allelomorphic sex-linked characters, 1,893 chicks were hatched from four different flocks of Barred Plymouth Rock hens by crossing them with Rhode Island Red roosters in three flocks and Buff Orpington roosters in the other flock.

Records of the colors and patterns of the birds at birth were kept, and their sex was determined by dissection when they died or were killed young or at maturity. There were several color combinations and gradations between them that appeared in the chicks, but about 92 per cent of the chicks were assigned to two classes, i. e., male chicks which exhibited the barred down pattern with a white spot on the top of the head and female chicks which were black or some variant of black. The presence of silvering in the down could be used to distinguish the sexes almost perfectly. Explanations were given for the exceptions which occurred. Observations on the mature birds indicated that the females were satisfactory egg producers, and the method was recommended for practical use to select pullets at hatching time.

A table is presented showing the colors and breeds which may be crossed and the characters of the male and female chicks for determining the sexes of hatching.

[**Poultry experiments at the Idaho Station**] (*Idaho Sta. Bul. 131 (1923), pp. 53–55*).—The following experiments with poultry are reported:

[*Protein for laying hens*].—Another year's results of this experiment are summarized in conjunction with those for the first year (E. S. R., 47, p. 870). Sour skim milk has been satisfactory as the main source of protein, but the addition of about 12 per cent of meat meal tends to increase the size of the eggs, though the ration costs more. Pea meal making up 25 per cent of the mash was satisfactory when sour skim milk was fed. Dried buttermilk was not as good an egg producer as sour skim milk.

Study of eggs.—The average weight of 2,544 eggs from 25 Single Comb White Leghorn hens laid between March 22 and October 1 was 63.1 gm. "Eighty-seven and seven-tenths per cent of the eggs were chalk white, 10.1 per cent slightly tinted, 1.7 per cent creamy, and 0.5 per cent light brown. In texture 74 per cent of the 2,398 eggs handled were normal, 22 per cent rough, and 4 per cent very porous. In shape 85 per cent were normal, 5 per cent were round, 5.6 per cent long and slender, and 4.4 per cent irregular in shape. There were 1,214 eggs candled, and 3.4 per cent were found to be transparent, 56.6 per cent cloudy, 39.4 per cent dark reddish, and 0.6 per cent bloody." No consistent abnormalities in the color of the yolks or other interior characteristics were noticed in the eggs of individual birds or were attributed to different methods of feeding.

Method of feeding oats.—In comparing dry, soaked, and sprouted oats for egg production, a pen of birds receiving dry oats gave the highest and most economical production. Sprouted oats gave slightly better results than soaked oats.

[**Poultry experiments at the Iowa Station**] (*Iowa Sta. Rpt. 1922, pp. 28–31*).—A study of the characters indicative of egg production in pullets has shown that vigor, vitality, and constitution are of prime importance. Early maturity is absolutely necessary, but it should not be at the expense of size.

As the result of comparing different rations and methods of feeding young chicks, several rations are suggested for practical use (E. S. R., 47, p. 780).

A comparison of semisolid and dried buttermilk with fresh buttermilk for fattening poultry has shown that the fresh buttermilk is superior to either of the dried products. Preliminary results of a test of different feeds for egg production indicate that dried and fresh buttermilk are superior to tankage and beef scrap.

Nutrient requirements of growing chicks (*Nebraska Sta. Rpt. 1922, p. 12*).—A continuation of the study of different kinds of animal protein for growing chicks (E. S. R., 47, p. 781) includes a comparative study of dried buttermilk and meat meal. The protein foods were added to a basal ration in amounts of 5, 15, and 25 per cent. The 15 per cent meat meal and the 15 per cent dried buttermilk lots, however, produced the best growth.

Back-yard poultry keeping, R. R. Slocum (*U. S. Dept. Agr., Farmers' Bul. 1331 (1923), pp. II+23, figs. 15*).—This is a revised edition of Farmers' Bulletin 889 (E. S. R., 38, p. 374).

New Jersey's poultry exhibitions, W. C. Thompson (*New Jersey Stas. Hints to Poultrymen, 11 (1923), No. 11, pp. 4, fig. 1*).—This consists mainly of a discussion of the advantages to be gained from poultry exhibitions by the exhibitors and by persons conducting and attending the exhibits.

DAIRY FARMING—DAIRYING.

Better dairy farming, E. S. SAVAGE and L. A. MAYNARD (*Ithaca, N. Y.: Savage-Maynard Co., 1923, pp. VIII+250, pl. 1, figs. 49*).—This is a manual on dairy farming. Approximately one-half of the book consists of descriptions and analyses of feeds, principles, and standards for feeding dairy cattle and young stock, and discussions and methods of mixing and buying feeds individually and cooperatively. The balance of the book discusses the more important breeds of dairy cattle and recommends methods of managing and breeding the dairy herd, and contains much other material of primary interest to the practical dairy farmer.

Practical dairying, D. G. SAKER (*London: Methuen & Co., Ltd., 1921, pp. VIII+128, pls. 3, figs. 16*).—This is a general book on dairying, dealing mainly with the production and sale of milk and cream and the manufacture of butter and cheese.

The forty-first annual report of the Dairymen's Association and of the Dairy School of the Province of Quebec (*Soc. Indus. Lait. et École Lait. Prov. Québec Rap., 41 (1922), pp. X+129*).—This is the usual annual report of this association (E. S. R., 48, p. 772) and includes a number of papers on dairying, most of which are of popular interest.

An experiment manger, A. C. MCCANDLISH and F. ELY (*Jour. Dairy Sci., 6 (1923), No. 3, pp. 245, 246, fig. 1*).—A manger which has been used for experimental dairy cattle feeding at the Iowa Experiment Station is described and diagrammed.

[**Experiments with dairy cattle at the Idaho Station**] (*Idaho Sta. Bul. 131 (1922), pp. 31–35*).—The results of the following experiments with dairy cattle are reported:

Corn silage v. sunflower silage for milk production.—In comparing corn and sunflower silage for milk production, 2 groups of 4 cows each were fed by the double reversal method. The feeding periods lasted 30 days, with 10-day transition periods. The silages were fed ad libitum, with equal amounts of alfalfa hay to both lots and grain according to production. Normal body weights were maintained on both kinds of silage. An average production for 30 days on corn silage of 740.3 lbs. of milk and 31.52 lbs. of fat was made, as compared with a production of 827.8 lbs. of milk and 30.79 lbs. of fat on sunflower silage. The amount of sunflower silage consumed was somewhat less than the amount of corn silage and, therefore, the economy of production according to dry matter consumption was 11.4 per cent in favor of the sunflower silage in the case of the milk and 1.07 per cent for the fat. A study of the yields per acre of sunflower and corn silage shows that a greater amount of milk could be produced from the same amount of land with sunflower silage than with corn silage.

Idaho pasture crops for milk production.—In studying the carrying capacity of sweet clover pasture, two fields of 1 acre and 0.8 acre, respectively, were pastured by Holstein cows which received additional grain at the rate of 1 lb. per 4 lbs. of milk produced. A crop of hay was cut from the 0.8 acre plat before pasturing. The 1-acre plat furnished 234.5 cow days of pasture, whereas the 0.8-acre plat furnished 145.6 cow days pasturing per acre. It is calculated that more feed per acre was produced when the hay crop was not removed.

Two Jersey cows receiving 1 lb. of grain per 3 lbs. of milk produced were pastured for 128 days on 4 acres of a mixed grass pasture consisting mostly of Kentucky blue grass and orchard grass. A total of 3,287.9 lbs. of milk and 195.29 lbs. of fat were produced.

Wintering young dairy cattle.—In comparing rations for wintering young dairy cattle, 3 lots, each consisting of 3 heifers and a bull were selected and wintered for 154 days on the following rations: Lot 1 alfalfa hay ad libitum, lot 2 alfalfa hay and corn silage ad libitum, and lot 3 alfalfa hay and dried beet pulp soaked with water (1:4) fed ad libitum. The animals in lot 1 consumed an average of 16.71 lbs. of hay per head per day and made average daily gains of 1.02 lbs. in weight and 0.047 cm. in height at withers. The animals in lot 2 consumed an average of 11.95 lbs. of alfalfa hay and 20.96 lbs. of silage and made gains of 1.57 lbs. in weight and 0.056 cm. in height at withers per day. The animals in lot 3 consumed an average of 10.62 lbs. of alfalfa hay and 34.34 lbs. of beet pulp and made average gains of 1.52 lbs. in weight and 0.063 cm. in height per day. All lots were in good condition at the end of the test, but none had made normal growth. The average ages at the start of the test were in lot 1, 9 months and 27 days; lot 2, 11 months and 2 days; lot 3, 11 months and 3 days. From the standpoint of economy and growth, a ration of alfalfa hay, corn silage, and a little grain is recommended for growing young dairy cattle.

Wintering dairy cattle.—Two groups of 7 Holstein heifers each averaging nearly 20 months of age were wintered at the Caldwell Substation without shelter on the following rations: Lot 1 chopped alfalfa hay ad libitum and lot 2 chopped alfalfa hay and corn silage ad libitum. The heifers of lot 1 averaged 863 lbs. at the start and made average daily gains of 1.2 lbs. during the test of 125 days. They consumed 26.377 lbs. of hay per day. The heifers of lot 2 averaged 877 lbs. at the beginning of the test and made average daily gains of 1.3 lbs., consuming 21.53 lbs. of alfalfa and 12.27 lbs. of corn silage per day during the 118 days that they were on test. Both lots were in good condition at the end of the experiments. The ration of hay alone was slightly more economical for wintering heifers.

[**Dairy cattle experiments at the Iowa Station**] (*Iowa Sta. Rpt. 1922, pp. 25–28, 37, 57, 58*).—Several experiments with dairy cattle are reported in addition to the results of those noted previously (E. S. R., 49, p. 578) and in the following abstract.

The use of drugs to stimulate milk production.—In using drugs to stimulate milk production, it has been found impossible to increase the fat yield with any of them. An aloes-rhubarb mixture has been found to increase the fat test, but it was accompanied by a decreased milk yield with all but one cow which showed an increase of 1 per cent.

Value of purebred sires on scrub and grade cows.—The second generation animals in this experiment have shown greater increases over their dams' records than the first generation did over their dams' (scrubs) records (E. S. R., 41, p. 182).

A study of the calcium balance of dairy cows, W. G. Gaessler and A. C. McCandlish (*Jour. Biol. Chem., 56 (1923), No. 2, pp. 663–678*).—In the first of two experiments carried on at the Iowa Experiment Station, 3 rations were fed to 3 cows for 10-day periods each, with preliminary periods of 20 days. The ration in period 1 consisted of cracked corn, gluten feed, wheat bran, oil meal, and timothy hay and was described as high in fat, low in calcium, and containing no free acid. In period 2 the ration consisted of ground oats, wheat bran, alfalfa hay, and beet pulp and was described as low in fat, high in calcium, and containing no free acid. In period 3 the following materials were fed: Cracked corn, ground oats, oil meal, timothy hay, and corn silage. This ration was high in fat, low in calcium, and contained free acid. In the second experiment similar rations were fed.

The outstanding results of the investigation were that negative calcium balances were observed in all cows except in period 2 of the first experiment, when positive calcium balances of 0.78, 1.14, and 1.5 lbs. of CaO, respectively, were maintained by the 3 cows. The positive balance during this period was attributed to the presence of a substance aiding calcium assimilation which was present in the alfalfa hay. The negative calcium balance in the second experiment when alfalfa hay was fed was explained as due to the destruction of the substance for calcium assimilation by storing the hay for 1½ years. The fat content of the ration, the loss of calcium in the form of soaps in the feces, and the presence of acids of corn silage in the ration seemed to have no influence on the calcium balance. The phosphorus and magnesium balances followed the calcium balances in a general way.

The minimum of rough fodder in rations for milch cows, K. M. Zubrilov (*Trudy Moskiv. Oblastn. Selsk. Khoz. Opytn. Sta.* (*Works Moscow Regional Agr. Expt. Sta.*) *Bul. 1 (1922), pp. 33–65, 123*).—Experiments carried on at three farms in the Moscow and Jaraslav regions, Russia, by the Moscow Regional Experiment Station to study the minimum amount of hay that it is possible to feed dairy cows are reported. A total of 45 cows were divided into lots of 5 each and fed on rations containing beets, turnips, cake, and dried residues of beet root factories, with sufficient bran added to equalize the starch value of the rations. The experiments lasted from 20 to 52 days, and analyses of the feeds consumed and the milk produced were made. The records of the milk production and weights of the animals were recorded.

The author concludes that as low as ½ lb. of hay per 40 lbs. of live weight may be successfully fed to dairy cows, and more milk with a higher percentage of fat resulted in such cases than when from ¾ to ⅞ lb. of hay was fed per 40 lbs. of live weight. Smaller amounts of hay resulted in a lessening of the milk yield. Small quantities of hay resulted in losses of 40 to 60 lbs. in live weight, and some digestive disturbances occurred. Roots tended to improve the digestion and increase milk yields.

An English abstract of the article is given.

Feeding the dairy cow without silage, J. J. Hooper (*Ky. Agr. Col. Ext. Circ. 143 (1923), pp. 4, fig. 1*).—Rations for feeding dairy cattle when silage is not available are suggested. More grain and hay must be fed, and wet beet pulp, roots, or winter pasture may help supply the need for succulent feeds.

Cod liver oil in the winter feeding of milch cows, J. C. Drummond, K. H. Coward, J. Golding, J. Mackintosh, and S. S. Zilva (*Jour. Agr. Sci. [England], 13 (1923), No. 2, pp. 144–152*).—In cooperative experiments at the University College and Lister Institute at London and the National Institute of Dairy Research at Reading, the vitamin A content of the milk of three groups of cows was tested at the end of the pasture season, during regular winter feeding, and after 15 to 120 gm. of cod liver oil were administered to each cow per day. The control cows received equal doses of olive oil. As the period of winter feeding advanced the vitamin and lipochrome contents of the butter decreased, but when cod liver oil was fed the vitamin A content of the milk was increased even above that of cows receiving a little winter pasture, though there was not the corresponding increase in lipochrome content as occurs with good grass pasture.

In another experiment, carried on at the Wye Agricultural College, Kent, by V. C. Fishwick and the director, silage in the ration did not give materially better results than mangels as far as increasing the vitamin A content of the milk was concerned.

To determine the effect of cottonseed meal on cows and heifers in reproduction, S. Combs and R. S. Curtis (*North Carolina Sta. Rpt. 1922, pp. 44,*

45).—A continuation of the experiment in feeding cottonseed meal to dairy cattle gave results similar to those previously noted (E. S. R., 47, p. 580).

Microscopic and macroscopic anatomical development of the bovine ovary, W. F. VAN BEEK (*Microscopisch- en Macroscopisch Anatomisch Onderzoek naar de Ontwikkeling van het Ovarium bij het Rund. Proefschr., Veeartsenijk. Hoogesch., Utrecht, 1921, pp. XII+143+6, pls. 23*).—This is a study at the Utrecht High School of the histological and anatomical changes as they occur in the development of the ovary in cattle from soon after conception until the first oestral period has occurred. The sex glands of 23 fetuses from 9 to 800 mm. in length and of 7 heifer calves from 3 days to 8 months of age were examined. One fetus 19 mm. in length was a male, but the others were all females except two 9 and 15 mm. in length, respectively, for which it was impossible to determine the sex.

Microphotographs of the sex glands of each animal are shown, and a bibliography of 131 references is given. The conclusions of the work are summarized in English.

The composition of secretions obtained from the udders of heifers during pregnancy, H. E. WOODMAN and J. HAMMOND (*Jour. Agr. Sci. [England], 13 (1923), No. 2, pp. 180–191*).—In continuation of the study of the fluid in the udders of virgin heifers (E. S. R., 47, p. 79), the composition of the fluid from the udders of heifers during the fifteenth, twenty-second, and twenty-eighth weeks and the last month of pregnancy are reported.

No essential changes were found to occur in the mammary system during the first 4 or 5 months of pregnancy, after which the secretions gradually become honey-like and contain about 40 per cent total solids, of which 35 per cent is globulin. Removal of this secretion tends to activate the gland to more normal production, the fluid containing colostrum constituents at first. The secretions of cows dry 2 to 3 months were found to resemble those of heifers in the early stage of pregnancy. A possible use of the honey-like substance for preserving antibodies in preparing antitoxin is suggested.

Cream-rising power in the milk from different breeds, J. D. WILLIAMS (*Jour. Brit. Dairy Farmers' Assoc., 35 (1923), pp. 25–33, fig. 1*).—Composite samples of milk from goats and the different breeds of dairy cattle were taken at the London Dairy Show in October, 1922. Tests of the percentage of cream rising and the percentage of butter fat in the milk were made, and the breeds were ranked according to the fat percentage, percentage of the cream in the milk, cream rising power, and depth of color of the milk. A practical application of the tests was suggested in choosing the breeds most adaptable for cheese making, butter making, or market milk production. The breeds represented were goats, Shorthorn, British Friesian, Red Poll, Lincoln Red Shorthorn, Kerry, Ayrshire, Dexter, Welsh, South Devon, Devon, Guernsey, and Jersey, given in order of the percentage of cream rising from the milk, this being 4.35 per cent for goats and 17.55 per cent for Jerseys.

[Bacteriological studies at the Iowa Station in dairy products] (*Iowa Sta. Rpt. 1922, pp. 38, 39*).—Organisms belonging to the *Streptococcus paracitrovorus* group have been isolated from milk, cream, and butter, and they have been found to produce considerable amounts of volatile acids when 0.4 per cent citric acid was added to the milk before inoculation. Tests for citric acid in the milk after the organisms had worked were negative. Some variation was observed in the action of different cultures, but there was not sufficient variation to justify a division of the group into types.

A preliminary study of the volatile acids produced by starters indicates that the main acid produced is acetic. Early in the ripening period propionic acid is also produced.

The production, composition, and utilization of whey, R. A. BERRY (*Jour. Agr. Sci. [England], 13 (1923), No. 2, pp. 192–239*).—This is the report of an investigation into the production, composition, feeding value and utilization of whey in Scotland by the West of Scotland College of Agriculture. Records of amounts of milk being used for cheese making and whey produced at different factories and on farms and their composition at different places and during different parts of the year are thoroughly considered. Estimates of the feeding value of whey, largely for pigs, are given, as taken from other sources. The better and more economical utilization of whey is recommended, especially as a hog feed or for the manufacture of sugar, though it may also be dried, used as fertilizer, or butter made from it. An extensive list of references is cited throughout the paper.

Study of the principles of ice cream making (*Nebraska Sta. Rpt. 1922, pp. 13, 14*).—In studying the influence of the percentage of fat upon the quality, body, and yield of ice cream, mixes containing from 6 to 20 per cent of butter fat were prepared, pasteurized at 140° F., homogenized at 2,500 lbs. pressure, and aged for 48 hours at 30° before freezing. The mixtures containing 18 and 20 per cent of fat produced ice cream having the best consistency and flavor, as well as the best yield.

VETERINARY MEDICINE.

Specialized zootechny.—II, Diseases of young animals, E. CUROT (*Zootechnie Spéciale.—II, Maladies du Jeune Bétail. Paris: Libr. Sciences Agricoles, 1923, vol. 2, pp. X+413, figs. 19*).—This volume, supplementing that noted on page 772, deals with the diseases of young animals.

Regulations governing the meat inspection of the United States Department of Agriculture, effective November 1, 1922 (*U. S. Dept. Agr., Bur. Anim. Indus. Order 211, rev. (1922), pp. III+107*).—Regulations governing meat inspection (E. S. R., 32, p. 777) have been revised and brought together in this form.

Proceedings of the thirty-eighth and thirty-ninth annual conventions of the Pennsylvania State Veterinary Medical Association held at Harrisburg, Pa., in January, 1921 and 1922 (*Penn. State Vet. Med. Assoc. Proc., 38 (1921), pp. 185; 39 (1922), pp. 136*).—The proceedings of the annual meetings of the association are presented.

Persistence of neurovaccine in the testicle, the ovary, and the lungs of immunized animals, C. LEVADITI and S. NICOLAU (*Compt. Rend. Acad. Sci. [Paris], 177 (1923), No. 8, pp. 466–568*).—Evidence is presented that in rabbits inoculated either intravenously or cutaneously with neurovaccine (E. S. R., 49, p. 378) the organism is apparently able to multiply in the testicles, ovaries, and more rarely in the lungs, even after the skin and brain have acquired immunity. After a longer period of time these organs in turn become sterile and the immunity general. This is thought to indicate that immunity is established by stages, various tissues becoming immunized independently of others.

On the changes in the blood and the distribution of the virus in rabid animals, M. OHAHI (*Jour. Japan. Soc. Vet. Sci., 2 (1923), No. 2, pp. 203–211*).—This is a report from the veterinary laboratory of the Ministry of Agriculture and Commerce, Tokyo.

"In the blood of an animal injected with a dose of the fixed virus of rabies, the number of leucocytes decreases after injection of the virus, then begins to increase with the first symptoms of the disease, and still increases in the paralytic stage. Just before death the number of leucocytes has reached

twice or more that before injection. In the acute course of the disease (two days), however, it has shown a tendency to decrease in number.

"The number of lymphocytes, which gradually increase after injection, begins to decrease just before the appearance of symptoms, and then falls to one-seventh of the normal number. The number of polymorphonuclear neutrophilic leucocytes decreases gradually after injection, begins to increase with the first symptoms and in paralytic stage, and just before death it runs up even to twice the normal number. The large mononuclears and intermediate forms show a tendency to increase gradually in number after the appearance of the symptoms and at last reach twice the normal number.

"No remarkable change could be found in the eosinophilic and basophilic leucocytes, though a slight decrease in the number could be traced. The myelocyte and metamyelocyte count has shown an increase in the paralytic stage. Any abnormal types of erythrocytes could not be found, but sometimes something like the Howell Jolly's corpuscles could be seen. In the blood of the control animal, injected with a dose of emulsion made from the normal brain, no change but a slight lymphocyte gain took place. With regard to the distribution of the rabies virus in various organs of the infected body, it has been found that the brain, spinal cord, and nervous plexus are always virulent, and the aqueous humor and submaxillary glands in all cases contain the virus. Adrenals, pancreas, liver, and lymphatic glands are sometimes virulent, but the blood, spleens, lungs, kidneys, lachrymal glands, muscles, and bone marrow are quite free from the virus."

Some new attempts at immunotherapy and chemotherapy in tuberculosis, P. Rondoni (*Bol. Ist. Sierotera. Milan., 2 (1922), No. 4, pp. 235–242*).—The author reviews and discusses some of the literature on attempts at immunization against tuberculosis and the treatment of the disease by chemotherapy. Particular attention is given to investigations involving the use of the partial antigen of Deycke and Much, and of Friedmann's turtle bacillus. In the discussion of chemotherapy a list is given of various substances which have been used, with the general results obtained.

The tuberculin test in cattle, O. Bang and A. J. Velling (*K. Vet. og Landbohøjsk. [Copenhagen], Aarsskr. 1922, pp. 191–281*).—The results are reported of the simultaneous use of human and bovine tuberculin in testing cattle which later, on autopsy, were found to have tuberculous lesions. The human tuberculin was injected in the left side of the neck and simultaneously bovine tuberculin in the right side, and the swelling of the skin was measured at 24-hour intervals, a thickness of 4 mm. being considered a positive test. Simultaneously the conjunctival test was made with human tuberculin in the left eye and bovine in the right eye. The amount of tuberculin injected in all cases was 0.1 cc. of a 50 per cent solution of crude tuberculin. Temperature readings were taken hourly for 23 hours. After 7 days the tuberculin treatment was repeated in the same manner.

As to the intradermal reaction, in the first test out of 119 animals tested 89.9 per cent reacted to the human, 94.1 to the bovine, and only 5 per cent to neither test. The reaction to the bovine tuberculin tended to appear earlier than to the human. At each time interval a higher percentage of positive reactions occured with the bovine than with the human tuberculin. The test at 72 hours gave the highest percentage of reactions in both cases, 84.9 per cent in the human and 89.9 in the bovine. The reaction was more intense to the bovine than to the human tuberculin, the maximum swellings being 10 mm. and 8.7 mm., respectively. A few of the animals, however, gave a more intense reaction to human than to bovine tuberculin, and one reacted only to the human.

On repeating the test after an interval of a week on 105 of the 119 animals originally tested, 90.5 per cent reacted to the human, 92.4 to the bovine, and 95.2 per cent to either one or the other. The intensity of the reaction was slightly higher with the human and slightly lower with the bovine tuberculin than in the first test. Of 11 animals which gave no reaction to human tuberculin in the first test, 7 reacted in the second, and 4 still remained negative, while 6 which gave positive reactions on the first test did not react to the second. Similar results were obtained with the bovine tuberculin. The animals which no longer reacted at the second test were the very tuberculous, while those reacting at the second and not the first in almost all cases had old insignificant tuberculous lesions which were sensitized by the first test. The reaction reached its maximum at an earlier hour in the second test than in the first and the intensity of the reaction was in general greater, although a few exceptions to this were noted.

Following intradermal injections in 134 nontuberculous animals, there was only 1 positive and 1 doubtful reactor. In these 2 cases the injection of 0.1 cc. of avian tuberculin gave positive results. From this it was concluded that the reactions were due to paratuberculous enteritis. In 5 other animals in which human tuberculin had produced a slight reaction, the injection of avian tuberculin caused a similar swelling.

Of the animals in the first series, 107 had a normal temperature when the intradermal injection was made. Of these 95 showed a rise in temperature following the injection. Of the 12 animals which showed no thermal reaction, 11 gave positive results with bovine tuberculin and 10 with human tuberculin. Of 11 animals which gave no reaction to human tuberculin, 9 gave a temperature reaction, and of 6 giving no reaction to bovine tuberculin, 5 gave a thermal reaction. The lack of agreement between the thermal and intradermal reactions is thought to indicate that the two reactions are due to different substances either in the tuberculin or in the organism itself.

In the conjunctival test 97 per cent reacted to human and 96 per cent to bovine tuberculin on the second test, and 67 per cent to human and 70 per cent to bovine in the first test.

Tularaemia, IX, X, E. FRANCIS (*Pub. Health Rpts. [U. S.], 38 (1923), No. 25, pp. 1391–1404*).—Two papers are here presented, in continuation of those previously noted (E. S. R., 49, p. 455).

IX. *Tularaemia in the Washington (D. C.) market* (pp. 1391–1396).—The author reports briefly upon the occurrence of tularaemia in a market man in Washington, D. C., which was contracted while working at a rabbit stand in November and December, 1921. Examinations of rabbits from Tennessee, Kentucky, and Kansas being offered for sale at the market, made for evidence of tularaemia, resulted in the finding of a number the livers of which, on gross examination, showed numerous small foci of necrosis indicative of this disease. A confirmation of the diagnosis was obtained by the injection of material from each suspected liver into a guinea pig. Three cases of tularaemia in man at Cincinnati and a case at Charlotte, N. C., are recorded. A discussion of market infections in rabbits and of the diagnosis of tularaemia with laboratory tests is included.

X. *The amino-acid cystin in the cultivation of Bacterium tularense* (pp. 1396–1404).—Having found cystin, when added to fresh beef infusion peptone agar, favorable for the prolonged cultivation of *B. tularense*, tests were made of other amino acids, which are reported upon.

Infectious abortion in cattle, IV, G. C. WHITE, L. F. RETTGER, and L. M. CHAPMAN (*Connecticut Storrs Sta. Bul. 112 (1923), pp. 177–240*).—In this fourth report (E. S. R., 47, p. 386) the authors present a brief calving his-

tory of 13 herds which have been under observation for from 2 to 8 years and show the relation of the agglutination and complement fixation tests to the calving records of the individual cows. Much of the data is presented in tabular form.

"The detailed breeding and blood reaction records are given for 9 herds covering a period of 36 herd years, 1,209 cow years and 1,097 calvings of which 933 gestation periods were for more than 265 days (normal) and in which 164 calvings resulted in abortions (less than 265 day gestation periods). There were 90.7 calvings from each 100 cows per year; 77.1 cows from each 100 carried calf 265 days or more, resulting in a herd efficiency in reproduction and milk stimulation of not over 77.1 per cent of the maximum capacity; and 14.9 per cent of the 90.7 calving cows calved in less than 265 days from the time of conception and are thus classed as aborters.

"In the 1,209 cow years there were 51 animals which gave a positive or doubtful reaction (doubtful generally indicates present or recent infection) to the complement fixation and agglutination tests, to 49 nonreactors out of each 100 cows. The normal calving cows show a relation of 43 infected to 57 uninfected; the cows which did not calve annually have a relation of 58 infected or positive reactors to 42 uninfected or nonreactors; and the aborting cows stand 90 positive to 10 nonreactors. This shows conclusively that not all positive reacting cows abort at each gestation; that some nonreactors do not calve annually for one reason or another, although they are more efficient breeders and more likely to reproduce than the infected cows; and it shows decisively the very high correlation between the test for the *Bacterium abortus* organism and premature calving."

Further investigations of infectious abortion of cattle, H. Zeller (*Arch. Wiss. u. Prakt. Tierheilk., 49 (1923), No. 1–3, pp. 65–116*).—This report of investigations of the etiology of abortion, the cultivation and resistance of the abortion bacillus, diagnosis, etc., includes a bibliography of 151 titles.

Studies on bovine influenza, H. Futamura (*Jour. Japan. Soc. Vet. Sci., 2 (1923), No. 2, pp. 200–202, pls. 2*).—This is the second report (E. S. R., 49, p. 79) on studies of bovine influenza from the veterinary laboratory of the Ministry of Agriculture and Commerce, Tokyo, based upon an outbreak in a dairy herd in which 22 calves and 23 cows were affected. Treatment, which included the application of an immune serum, resulted in the recovery of all the cows, but 13 of the calves succumbed. The author is of the opinion that the bipolar bacillus is a causal agent of the disease.

Pleuropneumonia of bovines, due to a new bacillus, R. Van Saceghem (*Compt. Rend. Soc. Biol. [Paris], 89 (1923), No. 24, pp. 446–448; also in Ann. Méd. Vét., 68 (1923), No. 6, pp. 251–254*).—This is a brief report of studies of bovine pleuropneumonia in East Africa (Ruanda), caused by an organism new to science. The causative agent, which has been isolated from lesions of the lungs and pleura and from the blood of animals which have succumbed to the acute form of the disease, is a very small nonmotile coccobacillus, which is Gram and Ziehl negative. It is cultivated with difficulty on ordinary gelatin but readily on gelatin containing gum arabic. The disease appears in acute, subacute, and chronic forms.

The detection of worm eggs in the feces of animals, and some experiments in the treatment of parasitic gastritis in cattle, A. L. Sheather (*Jour. Compar. Path. and Ther., 36 (1923), No. 2, pp. 71–90, fig. 1*).—The first part of this work (pp. 71–81), dealing with the detection of the eggs of parasitic worms in the feces of animals, describes a method of examination that has been found to yield results sufficiently constant to render it of great value in diagnosis and in estimating the value of any form of treatment. The method

has been proved to be applicable to the feces of cattle, horses, sheep, and dogs for the detection of the eggs of of strongylids and ascarids.

"Emulsify the feces with water until their mobility approximates to that of water. Strain through wire gauze which has 30 meshes to the linear inch. Mix with an equal volume of a solution of sugar prepared by dissolving 1 lb. of sugar in 0.75 pint of water. Centrifuge for two minutes at 2,000 to 2,500 revolutions per minute. Attach a piece of plasticene to the end of a wooden handle. Draw it out into a blunt point and bend it at right angles to the handle. Lift a cover glass of such size that it will just enter the mouth of the centrifuge tube by pressing the plasticene point gently on to its center. Lower the cover glass until it is in contact with the liquid throughout its extent. Withdraw it again, tilting it slightly, and detach it from the plasticene so that it falls on to a slide. Examine under a low magnification. The lenses used during the investigation were No. 3 Reichert with No. 4 eyepiece."

The second part of this paper (pp. 81–90), which reports experiments in the treatment of parasitic gastritis in cattle, has been summarized as follows:

"The drugs used for the treatment of parasitic gastritis in calves caused by *Ostertagia ostertagi* were turpentine, sulphate of copper, a mixture of sulphate of copper and sodium arsenite, tartar emetic, and carbon tetrachlorid. Turpentine was used in doses of 2 oz. and given in milk and in linseed oil, but without effecting any reduction in the number of eggs discoverable in the feces. Copper sulphate alone in doses of 12 gm. and in conjunction with sodium arsenite in doses up to 1 and 5 gm., respectively, failed to prove fatal to the worms in the stomach. Tartar emetic, given on one occasion only and in a dose of 16 gm. (4 dr.), was without effect. Carbon tetrachlorid was found to be not only useless for the treatment of the disease, but actually poisonous in a dose of 25 cc."

A diplococcus associated with caseous lymphadenitis and pneumonia of sheep, R. S. Spray (*Jour. Infect. Diseases, 33 (1923), No. 2, pp. 161–168*).—The studies here reported have been summarized as follows:

"In lesions of ovine caseous lymphadenitis in sheep with chronic pneumonia, a Gram-positive diplococcus with certain peculiar characteristics was found frequently either in pure culture or, as in most instances, associated with *Pasteurella ovisepticum*. The diplococcus was isolated in pure culture from caseous lymph nodes in three instances, and twice from purulent pneumonia. The Preisz-Nocard bacillus was not recovered by direct plating from any of the lesions studied.

"The diplococcus was slightly hemolytic when isolated and became more actively hemolytic on cultivation. It rapidly liquefied gelatin and Löeffler's serum and peptonized milk without coagulation. Inoculations were fatal to white mice and guinea pigs and in one instance each to a kitten and a puppy. In all cases, lesions in the livers of the animals were similar to the lesions in sheep, from which the organisms were originally obtained. Rabbits apparently are not susceptible to infection, judging from the negative results of a few inoculations.

All strains were identical agglutinatively. Antiserum for three strains protected white mice against doses of the homologous strains fatal to unprotected mice. From a review of the literature on pyogenic infections of sheep, it appears that this is probably an undescribed diplococcus which may be regarded as at least a complicating factor in ovine caseous lymphadenitis and in certain types of sheep pneumonia."

Parasites and parasitic diseases of sheep, M. C. Hall (*U. S. Dept. Agr., Farmers' Bul. 1330 (1923), pp. 54, figs. 34*).—This is a revision of and supersedes Farmers' Bulletin 1150, previously noted (E. S. R., 44, p. 582).

Cleansing sheep of stomach worms, R. S. CURTIS (*North Carolina Sta. Rpt. 1922, p. 53*).—A treatment for stomach worms of sheep found to be effective consists in the administration of 1.5 oz. of copper sulphate in 50 cc. of water to lambs and 3 oz. of copper sulphate in 100 cc. of water to ewes. This treatment should be given after the sheep have been kept off feed and water over night.

Diseases, ailments, and abnormal conditions of swine, T. P. WHITE (*U. S. Dept. Agr., Farmers' Bul. 1244 (1923), pp. II+26, figs. 8*).—This is a practical summary of information.

Infectious abortion in swine (*Illinois Sta. Circ. 271 (1923), pp. 4, figs. 2*).—This is a brief statement prepared for the breeder and stockman on the cause of infectious abortion, its recognition, and means of control.

The results of recent investigations concerning the virus of hog cholera. W. GEIGER (*Centbl. Bakt. [etc.], 1. Abt., Ref., 75 (1923), No. 13–14, pp. 289–312*).—This review of the literature on hog cholera is classified under the headings of biological behavior of hog cholera virus, behavior of the virus in the body, immunity, active immunization, passive immunization, simultaneous immunization, and serum immunization in practice. An extensive list of literature references is appended.

The kidney worm of swine: A short redescription of Stephanurus dentatus Dies., 1839, R. DAUBNEY (*Jour. Compar. Path. and Ther., 36 (1923), No. 2, pp. 97–103, figs. 5*).—This is a technical description of *S. dentatus* and includes a bibliography of 18 titles.

The topographical anatomy of the thorax and abdomen of the horse, O. C. BRADLEY (*Edinburgh: W. Green & Son, Ltd., 1922, pp. XII+204, figs. 85*).—This is a work prepared upon the same plan as that of the earlier account on the topographical anatomy of the limbs of the horse (E. S. R., 44, p. 377). Its aim is to serve as a sufficiently full dissection guide for the student and an aid to the practitioner. The subject is dealt with under the heads of the thorax (pp. 1–66), arteries of the thorax (p. 67), the abdomen (pp. 68–156), the pelvic cavity (pp. 156–180), the female pelvis (pp. 180–187), arteries of the abdomen (p. 188), nerve and blood supply of the muscles of the thorax and abdomen (pp. 189, 190), lymph glands of the thorax and abdomen (pp. 190, 191), the fetal circulation (pp. 192–195), and index (pp. 196–204). Many of the figures are in colors.

Observations of the incubation period and the course of equine infectious anemia, M. NAGAO (*Jour. Japan. Soc. Vet. Sci., 2 (1923), No. 1, pp. 101–107*).—The author presents tabular data on 37 horses under observation that were inoculated with the virus of infectious anemia. The incubation period varied from 2 to 47 days, and in 70 per cent of the cases it lay between 9 and 22 days, the quantity of blood injected having had no influence. In 38 per cent of the cases there was one attack, in 24 per cent two, in 21 per cent three, and in a few from four to nine. The maximum temperature ran from 40 to 41.5° C. (41.8° in one case) and seldom below 39.5° (39.4° in one case). Sixty-two per cent of the cases terminated unfavorably, of which one-half succumbed in one month.

Poultry investigations and pathology, B. F. KAUPP (*North Carolina Sta. Rpt. 1922, pp. 47–49*).—Under the heading of a study of the diseases of the fowl, the author refers briefly to a case of encephalocele of a baby chick, a horny growth from the foot of a hen, edema of the larynx, and polypus of the oviduct. Reference is made to laboratory studies of the temperature of the adult fowl, previously noted (E. S. R., 48, p. 381) and to studies of respiration (E. S. R., 48, p. 680).

Methods of administering anthelmintics to remove whipworms, with a note on a new method, S. M. LAMBERT (*Amer. Jour. Trop. Med., 3 (1923), No. 4, pp. 297–305*).—"Oil of chenopodium injected intramuscularly has little vermicidal action on hookworms, but in one case apparently had a marked action on whipworms. Oil of chenopodium, when injected intravenously, in doses of 1.5 to 2 cc. in three cases apparently had a marked vermicidal action on Trichuris, little action on Ascaris, and none on hookworms."

RURAL ENGINEERING.

Agricultural engineering [studies at the Iowa Station] (*Iowa Sta. Rpt. 1922, pp. 7–10*).—The results of studies on disk harrows, which have been previously noted from another source (E. S. R., 47, p. 190), and of the draft of farm implements (E. S. R., 45, p. 590) are reviewed.

Studies begun in 1914 on means of making impervious silo walls constructed of porous materials are said to have shown that the application of bituminous material to the surface is the most satisfactory treatment. When carefully applied, first by sizing with a solution of the bitumenum and later with a hot application, this treatment not only resists the action of the silage but has little tendency to peel or scale off.

Physical and chemical studies begun in 1912 on the relative durabilities of 35 brands of commercial 3-ply prepared roofing are said to have shown that materials having a high volatile content are less durable. A mineral surface of sand, gravel, asbestos, or mica materially improved the durability of the roofing. Exposure to the sun was the most destructive influence. Resinous knots in the sheeting were particularly destructive.

Observations begun in 1910 and 1912 on masonry water tanks constructed on silos for elevation led to the conclusion that the masonry silo provides a very desirable support for an elevated water tank, and that it is possible to make the masonry water tank tight over a number of years. By the use of double walls, freezing of the water in the tank during extremely cold weather was greatly reduced. A masonry water tank is considered to be practicable from the standpoint of cost.

Investigations begun in 1914 on 700 concrete fence posts of seven different types, different mixtures, and different styles and amounts of reinforcements are briefly reported. Six hundred and fifty of these posts were installed and 50 were tested for strength. These tests showed that four 0.25-in. square twisted reinforcement rods were needed to give the maximum strength without the excessive use of steel. All the posts placed in fences are still in use, but observation indicated that where the steel is close to the surface it has not been adequately protected from corrosion, and cracking of the post results. These defects have been developed in a small way only. The results are taken to indicate the possibility and practicability of making satisfactory concrete posts.

Surface water supply of the United States, 1919–1920, VI, X, XII (*U. S. Geol. Survey, Water-Supply Papers 506 (1923), pp. 411, pls. 2; 510 (1923), pp. VI+348, pls. 2; 512 (1923), pp. V+262, pls. 2*).—Part VI of this report, prepared in cooperation with the States of Montana, Wyoming, Iowa, Colorado, and Kansas, presents the results of measurements of flow made on streams in the Missouri River Basin during the years ended September 30, 1919 and 1920. Part X, prepared in cooperation with the States of Utah, Nevada, California, Oregon, Wyoming, and Idaho, presents corresponding measurements for the Great Basin, and Part XII, prepared in cooperation

with the States of Washington, Montana, and Idaho, for the Pacific Slope basins in Washington and the Columbia River Basin.

Surface water supply of Hawaii, July 1, 1918, to June 30, 1919 (*U. S. Geol. Survey, Water-Supply Paper 515 (1923), pp. IV+123*).—This report, prepared in cooperation with the Territory of Hawaii, presents the results of measurements of flow made on certain streams and ditches in the Territory of Hawaii during the year ended June 30, 1919.

Subterranean water and meteorologic agents, P. Ototzky (*Ann. Sci. Agron. Franç. et Étrangère, 39 (1922), No. 1, pp. 39–52*).—This is a brief summary of the results of a large number of studies, presumably conducted in Russia before the World War, on subterranean waters, their origin, régime, and distribution.

The studies of the relation of soil temperature and underground water, especially in wells, showed that whenever the temperature of the soil increased, the level of the water rose, and vice versa. This relation was more pronounced when the water-bearing stratum was near the surface, and when the soil and subsoil contained a large amount of fine material and had a high thermal conductivity. The influence of temperature changes in the soil appeared to be more marked when the upper layers of the soil were soaked with rain water. There was a noticeable daily and annual fluctuation in the level of well waters, the former being more visible in the summer. It is concluded that the soil temperature influences the water level in wells principally by changing the air pressure in the upper layers of soil, by the condensation of water vapor in the soil, and by changing the capillary tension of the underground water.

Barometric pressure was also found to have an influence on the variations in water level in wells, both regular and irregular. As the barometer rose the water level in wells was lowered, and vice versa. The effect of barometric pressure was more marked in the deeper wells, in the more compact soils, at the moment of change of pressure, and when the barometric gradient was high.

Studies of the relation of subterranean waters to precipitation led to the conclusion that the theory of infiltration does not possess a solid scientific basis. Researches on soil moisture and lysimetric and hydrometric observations are said to have shown that the infiltration of atmospheric precipitation to considerable depths will take place only under limited and exceptional conditions. Immediately following a rainfall or after a short interval, the level of well waters showed a considerable rise on a soil containing no colloids, and this also took place where an extremely dry layer of soil occurred between the top soil and the water-bearing stratum. The rise of water level was generally followed by a fall to its original elevation. It is concluded that the movement of the water level due to rain is caused not by the enrichment of the water-bearing stratum with rain water, but by a change in the hydrostatic pressure of the soil gases at the level of the subterranean water. This is contrary to the general opinion that rain causes an immediate rise in the level of subterranean water. It merely produces a depressing action on the water-bearing stratum.

Observations made on snow-covered plains in the spring generally showed a rapid and considerable rise in well waters, which increased with the rapidity with which the soil warmed up, with the moisture reserve in the soil, with the compactness of the soil, and with the depth of the water-bearing stratum. The rise commenced at the moment of melting of the last layer of frozen soil. After the maximum rise had taken place, there was a slow recession of the well water level.

Weirs and their construction, A. C. Jennings (*Rhodesia Agr. Jour., 20 (1923), No. 2, pp. 158–165, pls. 3*).—Information and drawings are given describing the construction of the low diversion type of irrigation weir con-

structed primarily for raising the level of a stream or river and affording convenient means of diversion. Standard specifications for rubble masonry and concrete used in the construction of weir walls are also included.

Trail construction on the national forests (*U. S. Dept. Agr., Forest Serv., 1923, pp. 81, figs. 40*).—The purpose of this handbook is (1) to state a general policy of trail construction and maintenance, (2) to establish a uniform classification of national forest trails according to their use, (3) to establish standard specifications for each class, and (4) to describe and illustrate for purposes of reference and application approved methods of location, construction, and upkeep.

Effect of organic decomposition products from high vegetable content soils upon concrete draintile, G. R. B. Elliott (*Jour. Agr. Research [U. S.]. 24 (1923), No 6, pp. 471–500, pls. 7*).—Studies conducted at the Minnesota Experiment Station on the influence of soils containing large amounts of organic matter upon concrete draintile are reported. Experiments were conducted in the laboratory and in different marsh and bog soils in the State.

Preliminary laboratory studies showed that marginal and bog waters were alkaline in February and indicated that concrete tile were very alkaline even after being in the drain for five years. Old and new tile appeared to be similar except as regards density, and thoroughly matured tile were soluble in weak organic acid. During a long period of curing concrete tile showed considerable absorption of carbon dioxid.

Further laboratory studies showed that partially decomposed tile had a tendency to set on grinding and moistening. The reaction of organic matter with concrete resulted in the production of gelatinous compounds which were soluble in carbonic acid. Organic compounds reacted with neat cement, and the quantity of acids in such organic compounds increased as decomposition proceeded.

The field studies showed that concrete tile as at present made break down in all peat soils in the presence of water, no matter what the underlying mineral soil may be. A high percentage of lime or even the presence of marl is no guaranty of immunity. A high percentage of lime was found to delay but not to stop the process of disintegration. Acidity of the subsoil and porosity in the tile are factors hastening the process of disintegration.

It is concluded that if free alkalinity is an inseparable characteristic of concrete as at present made, and if water is present, the ultimate destruction of concrete tile in the presence of organic acid seems inevitable since the free alkali and the free acid must react against each other.

The manufacture of roofing tiles on the farm, A. J. Orner (*Rhodesia Agr. Jour., 20 (1923), No. 2, pp. 166–172, pls. 4*).—Practical information on the manufacture of roofing tiles for use in the construction of farm buildings in Rhodesia is presented.

Canadian Sitka spruce: Its mechanical and physical properties, L. L. Brown (*Canada Dept. Int., Forestry Branch Bul. 71 (1921), pp. 39, figs. 20*).—This bulletin presents the results of tests of the physical and mechanical properties of Sitka spruce.

The tests indicate that Sitka spruce grown on the Queen Charlotte Islands is stronger than that grown on the mainland in southern British Columbia by from 3 to 14 per cent. The Sitka spruce grown at Masset Inlet on these islands is of nearly identical strength properties with that grown at Thurston Harbor on the same islands. The variations from average results were found to be large in this as in other woods, and where a definite strength is demanded it can be established only by determining the density of the piece in question. The density of Sitka spruce is not readily apparent owing to the similarity

of color of the spring and summer woods and to the gradual transition from one to the other.

The strength of this wood increases from the pith to the periphery in trees of the size tested, the largest tree being more than 5 ft. in diameter. The weakest wood is thus near the center. The strength of small clear pieces was found to increase more rapidly when dried below the fiber saturation point, which is at approximately 31 per cent of moisture, based on the dry weight of the wood. Any increase of moisture above this point did not influence the strength of the piece.

Graphic data showing the relation between density and the various strength functions for Sitka spruce are included.

Coatings that prevent end checks in wood (*Engin. and Contract., Buildings, 59 (1923), No. 5, p. 1166*).—In a brief contribution from the U. S. D. A. Forest Service, the results of studies on water resistant end coatings for wood during air-seasoning or kiln-drying are briefly presented.

It has been found that either hot or cold coatings can be used effectively to prevent end checks for drying temperatures up to 140° F. Temperatures much above this cause blistering of the cold coatings but make the hot coatings plastic enough to form new surfaces as fast as the old ones break. For this reason the hot coatings are apt to be more effective than the cold coatings for temperatures from 140 to 170°. No coating has been found which is entirely satisfactory for temperatures above 170°.

It is stated that cold coatings to be effective should have about the consistency of heavy sirup. Cold coatings which have been found effective in laboratory tests are, in the order of their effectiveness, hardened gloss oil and air-slaked lime, Chinawood oil and barytes, linseed oil and white lead, linseed oil and red lead, and high-grade spar varnish and barytes. Of the coal-tar hot dips, 213° coal-tar pitch gave the best results, followed in order by 254° coal-tar pitch and rosin and lampblack. Paraffin proved very satisfactory for stock during air-seasoning, but could not be used in the kiln.

Nebraska tractor test analysis, O. W. Sjogren (*Jour. Soc. Automotive Engin., 12 (1923), No. 6, pp. 587–594, 609, figs. 26*).—A summary and analysis are given of the data secured during the past three years in the tractor testing work at the University of Nebraska. Data are presented on tractor rating, belt speeds, weight distribution, tractive efficiency, wheel slippage, piston displacement, and fuel and water consumption and interrelations thereof. Attention is also drawn to the importance of a standard method of rating tractors.

It is shown that the general trend of the relation of total engine weight and engine weight per brake horsepower indicates that the latter increases as the former increases. The general trend is toward a reduction in the tractive efficiency with an increase in the total weight of tractor beyond the 4,500-lb. weight. There also seems to be a tendency toward a decreased efficiency with tractors lighter than 4,000 lbs. With the wheel tractor the efficiency tends to become lower as the total weight per drawbar horsepower increases. The general tendency is for the tractive efficiency to vary in an inverse ratio to the weight on the drivers per drawbar horsepower.

The data further indicate that the lightest weight tractors are not so efficient as those of medium weight, except in the case of live-axle driven machines. A slight advantage is also noted in the gear drive over the live-axle drive, and no one number of gear reductions apparently has the advantage with respect to tractive efficiency.

The data on wheel slippage indicate the tendency of the angle lug to pulverize the surface of the test track after traveling over it several times to such an extent that a good grip could not be secured. The spade lugs gave the

best results on the track, due largely to the fact that they penetrated the ground to a sufficient depth to give a good grip and therefore did not cut or pulverize the surface. It is considered doubtful if the malleable bar lugs used on the larger tractors would give any better results on the light tractors than the angle lugs. It was further shown that as the total tractor weight increased the percentage of slip of the drive wheels decreased slightly.

Data on fuel consumption showed that no particular type of engine had the advantage in this respect. Fuel consumption tended to increase with an increase in the piston displacement. The lowest fuel consumption was secured with engines having a cylinder diameter of between 5 and 6 in. With horizontal cylinder engines, fuel consumption tended to decrease as the weight increased. This held true until an approximate weight of 7,000 lbs. was reached, after which the reverse was true. In the case of vertical cylinder engines, there was a slight increase in fuel consumption until the 7,000-lb. mark was reached, after which there was a marked decrease.

The I-type engine gave better fuel economy than the L-head engine on all operating loads. The rated brake load gave a better fuel economy than either the maximum or half loads. The fuel requirement on drawbar work was almost double that required on belt work per horsepower hour.

Defects in tractors indicated by these tests are discussed under the headings of engines, accessories, and chassis.

Pit, semipit, and bank silos, L. W. Chase (*Nebr. Agr. Col. Ext. Circ. 720 (1923), pp. 16, figs. 19*).—Practical information on the construction of pit, semipit, and bank silos, with particular reference to Nebraska conditions, is presented in this circular.

RURAL ECONOMICS AND SOCIOLOGY.

[Financial and statistical reports from the county experiment farms in Ohio in 1920 and 1921], C. W. Montgomery et al. (*Ohio Sta. Bul. 361 (1922), pp. 319–324, 348–356, 380–388, 395–398, 407, 408, 416–423, 435, 444–451, 478, 479, 482–484, 502, 503, 506–508, 512–514, 530–534, 546–551, fig. 1*).—Reports are submitted covering the financial results from certain crop rotations and livestock work, as well as crop summaries and labor statistics for the experiment farms in Miami, Paulding, Clermont, Hamilton, Washington, Trumbull, Mahoning, Belmont, and Madison Counties.

Farm capital and profits, A. G. Ruston and J. S. Simpson (*Jour. Min. Agr. [Gt. Brit.], 29 (1923), No. 11, pp. 984–992*).—Accounts for 38 farms in Yorkshire, England, in 1921–22 show that on the 9,308 acres concerned the capital investment per acre was £16 9s. 6d. A study of the returns would indicate that of the total capital on any farm at least 70 per cent should be in circulation, and that on a mixed farm at least 80 per cent and on a dairy farm 120 per cent of the capital should be turned over each year. The provision of short-term credits appears necessary. In the case of 13 of these farms recently purchased only 35 per cent of the purchase price had been paid, and the total annual charges were 8s. 9d. more per acre than the previous rent.

Fertilizers and land values, D. D. Long (*Fert. Green Book, 4 (1923), No. 6, pp. 20–30, figs. 7*).—Data from the census of 1920 are tabulated and presented graphically showing the relationship between crop values, fertilizer expenditure, and land values for all counties of North and South Carolina and Georgia together and for all counties of each State taken separately. Classifications are made of counties into groups with crop values less than $20 per acre, $20 to $40, $40 to $60, $60 to $80, $80 to $100, and over $100 per acre, respectively,

and the selling value of the land is shown to increase consistently with the crop value, which is in turn enhanced by the use of fertilizers.

The effects of the war as reflected in the costs of milk production, A. G. Ruston and J. E. Robinson (*Milk Indus., 3 (1923), No. 7, pp. 33–35, 37, 38, figs. 2*).—Detailed cost data for three farms in Yorkshire, England, including a small grass farm near Halifax, a mixed farm in the North Riding, and a mixed farm in the industrial area of the West Riding, are tabulated and presented in graphs as illustrating the rise in the cost of milk production from the outbreak of the war to a maximum in the year 1919–20 and the more gradual fall occurring since that time. The three factors of increased labor and food bills and depreciation of cows are discussed.

The relation of types of tenancy to types of farming in Iowa, C. L. Holmes (*Iowa Sta. Bul. 214 (1923), pp. 324–364, figs. 14*).—The effect of changes in the type of agriculture of the State on the increasing tenancy and on the methods of renting land is traced briefly through the 40 years since tenancy statistics were first available. The prevailing types of tenancy, cash, crop-share, and stock-share renting, are analyzed in their relation to the peculiarities of the farming in each section of the State, and the terms of rental under each tenancy type are given. Finally, the specific variations in the organization of the farm under the different types of tenancy are presented as revealed by the analysis of farm survey data from Clay, Greene, Henry, Montgomery, Tama, and Warren Counties. In conclusion, the importance of properly adjusting the lease bargain to the type of farming best fitted to each individual farm and to the characteristics of the leaseholder and the tenant is pointed out. In addition to the survey records noted, data from the Federal census and those collected in 1922 by the extension service of the college by means of a questionnaire have been utilized.

It is pointed out that in general, cash renting has prevailed in the areas where cattle feeding is most important, stock-share renting is prevalent in the dairy area, and crop-share renting prevails in the areas where a great deal of grain is sold and livestock is a comparatively minor enterprise. Locally it is found that the owner-operated farms and those stock-share rented lead in the amount of land in hay and pasture and the amount of receipts from livestock. The crop-share farms have the largest acreage in grain, the largest percentage of their receipts from the sale of crops, and the minimum area in hay and pasture. The cash rented farms fall about midway between these two types in their organization.

Weather, Crops, and Markets (*U. S. Dept. Agr., Weather, Crops, and Markets, 4 (1923), Nos. 5, pp. 113–136, figs. 3; 6–7, pp. 137–184, figs. 5; 8, pp. 185–216, figs. 4*).—Temperature and precipitation charts are presented for the weeks ended July 31 and August 14 and 21, 1923, together with general and weekly summaries of weather conditions. The usual weekly and monthly market reports, summaries and special articles setting forth the receipts and prices of important classes of crops and livestock, and the current position in the market of specific commodities are given. Estimates of crop conditions on August 1 appear in the combined numbers 6 and 7, together with the usual farm price tables and miscellaneous crop reports.

Farmers' Market Bulletin (*North Carolina Sta. Farmers' Market Bul., 10 (1923), No. 63, pp. 8*).—This number contains a brief description of the point-of-origin inspection of fruits and vegetables in 22 States that have entered into cooperative arrangements with the U. S. Department of Agriculture. The usual partial list of products which farmers have for sale is presented.

Marketing main-crop potatoes, W. A. Sherman, G. B. Fiske, and O. D. Miller (*U. S. Dept. Agr., Farmers' Bul. 1317 (1923), pp. II+37, figs. 16*).—

This discusses some of the underlying effects and conditions that influence prices, the sources and character of the information the grower should use, and the particular marketing problems of the producers of late or main-crop potatoes. The location, shipping season, and relative importance of nine heavy shipping districts are set forth, and brief descriptions are given of the methods of marketing pursued in certain typical areas, including the northern shipping point of Waupaca, Wis., the eastern potato section near Rochester, N. Y., and city markets such as Chicago, St. Louis, Kansas City, New York, Boston, Baltimore, Philadelphia, and others.

Egg prices and cold storage holdings, G. W. HERVEY (*New Jersey Stas., Hints to Poultrymen, 11 (1923), No. 10, pp. 4, figs. 3*).—The interrelationship that existed between temperature at New Brunswick, N. J., cold storage holdings, and top wholesale prices on white eggs in New York has been worked out for the 4-year period, November, 1918, to October, 1922, in order to obtain an approximate indication of the relation between temperature and the factors of price and storage. A summary of the data is presented graphically in three figures.

A striking relation between temperature and the number of cases of eggs weekly placed in cold storage in New York is noted. There was no consistency, however, between the number of cases of eggs in storage and the length of time they were held. The second graph indicates a stabilization of holdings at the extremes of temperature. The weekly fluctuations, although over 600,000 cases in some instances showed a uniform trend and did not assume the proportions noted when storage and price were considered. It is revealed that storage fluctuations on any two successive price groups below 70 cts. were for the most part uniformly large. Beyond the 70-ct. price, however, there was a uniform decrease in size of the variations in holdings from the mean, and when the price approached the dollar mark holdings were practically at a mean point.

Index to some sources of current prices, compiled by E. T. SHIVELY (*U. S. Dept. Agr., Library, Bibliog. Contrib. 5 (1923), pp. [2]+II+124*).—A mimeographed list is given of the periodicals quoting prices of agricultural commodities and the various important markets on which the prices obtain.

A history of agriculture in Wisconsin, J. SCHAFER (*Madison: State Hist. Soc. Wis., 1922, pp. XIII+212, pls. 38, figs. 14*).—This is designated as General Studies, Volume I, and is intended to serve as an introduction to the Town Studies of the Wisconsin Domesday Book, one volume of which is now in the press. The first chapter describes the geological and geographical features of the region, chapter 2 the early mining activities in the State and early settlements, and chapters 3 and 4 on pioneer origins and conditions make note of the races that settled on the land, the types of homes and other improvements that were built, and transportation. A chapter on wheat farming deals with the industry which was predominant until about 1880, and subsequent ones trace the development of diversified farming and the introduction of improved livestock. Chapter 8 describes the introduction of farming into cut-over timber lands, chapter 9 the introduction of dairying, and chapter 10 farm life and social conditions. The appendix consists of a census of old homesteads by counties, edited by E. L. Jacobson.

Agricultural staples and the tariff (*U. S. Tariff Comn., Tariff Inform. Ser. No. 20 (1920), pp. 190, pls. 9, figs. 12*).—This report, prepared with the assistance of L. B. Zapoleon, G. E. Putnam, and others, is a study of the production, trade, and foreign competition in wheat, oats, barley, flaxseed, hay, and potatoes in the United States and in Canada. Six separate commodity reports are made.

Supplemental information concerning the wheat and flour trade of the United States (*U. S. Tariff Comm., Tariff Inform. Ser. No. 20 (1921), Sup., pp. 15*).—This brief report is an extension of the wheat and flour section of the study noted above, giving supplementary information relative to developments since 1920.

Cattle and beef in the United States.—The tariff problems involved (*U. S. Tariff Comm., Tariff Inform. Ser. No. 30 (1922), pp. VI+125, pls. 3, figs. 5*).—This report, prepared with the assistance of L. G. Connor, C. K. Lewis, L. B. Zapoleon, and others, notes changes that have occurred in the industry since the United States virtually ceased to export cattle and beef. Domestic production costs, marketing, the beef-packing industry, the import and export trade of the United States, and production in the principal competing countries of Canada, Argentina, Uruguay, Brazil, Paraguay, Australia, and New Zealand are discussed, as well as the import trade of Great Britain. Estimated costs of production in Argentina, which were secured by an agent of the Tariff Commission for the period 1918–1920, are incorporated. Domestic and foreign prices, the history of tariff legislation with reference to cattle and beef, tariff considerations, and recommendations concerning the form which a duty, if levied, should take are also considered.

Child labor and the work of mothers in the beet fields of Colorado and Michigan (*U. S. Dept. Labor, Children's Bur. Pub. 115 (1923), pp. V+122, pls. 6*).—This study was made under the direction of E. N. Matthews in Weld and Larimer Counties in Colorado and in Gratiot, Saginaw, and Isabella Counties in Michigan, which were selected as representative of the beet raising areas in their respective States and sections. Families were selected for study in which at least one child under the age of 16 or the mother if she had a child under 6 years of age had worked in beet fields in 1920.

In the Colorado section 1,073 children between 6 and 16 years of age and in the Michigan section 763 had worked in the beet fields in the summer of 1920. In Colorado 85 per cent of the children worked from 9 to 14 or more hours a day in the thinning season, as compared with only 67 per cent in Michigan, which difference is accounted for by the relatively larger proportion of farm owners with small acreages included in the Michigan study. The Colorado children were more experienced workers than those in Michigan families, and the former cared for an average of 5.9 acres per child, whereas the Michigan workers averaged only 4.1 acres per child.

The average percentage of attendance for resident children in the Colorado section who attended schools making no special provisions for beet field workers was 74 per cent in the case of laborers' and 89 per cent in the case of farm owners' children, these percentages being 72 and 85, respectively, in Michigan. In Colorado summer sessions provided for beet field workers in a few towns had resulted in bringing up the percentage of attendance to 90 for laborers' as well as for farmers' children attending these schools. Of the resident children in Michigan beet field workers' families 35 per cent and of the corresponding group in Colorado three-fifths were retarded from 1 to 6 or 7 years. Supplementary studies of school attendance and retardation among resident children in both sections covering approximately 3,000 children in Colorado and 1,300 in Michigan showed that the school attendance of children of every age working in the beets was from 20 to 30 per cent less than that of nonworking children, and that the retardation was greater.

Family earnings from beet contracts ranged from less than $100 to $3,000 or more, according to the number of workers and their ability. In both sections studied the largest group, approximately one-fifth of the laborers' families, expected to receive from $800 to $1,000 for their season's work. About one-half

of the families in Colorado and less than one-third of those in Michigan earned $1,000 or more. The value of a child's work, if he engaged in all the processes, averaged in the Colorado section about $200, and in Michigan from $114 to $122.

Women worked about the same hours and approximately the same number of weeks as children, and during the busy seasons were able to give little attention to their homes or the care of their children. Babies were usually taken to the field. In many families they were left at home either alone or with older children, themselves often under seven years of age, to care for them.

AGRICULTURAL EDUCATION.

Educational surveys, E. F. BUCHNER (*U. S. Bur. Ed. Bul. 17 (1923), pp. 44*).—This is the fifth report of a special series begun in 1914 recording the educational survey movement, and is prepared with special reference to the biennium 1920–1922, noting also, however, a few surveys which were made between 1918 and 1920. It is published here as advance sheets from the Biennial Survey of Education in the United States, 1920–1922. One section covers the county and rural surveys which have been made in Pennsylvania, Georgia, Colorado, Ohio, Minnesota, Iowa, and New York.

Educational extension, C. G. MAPHIS (*U. S. Bur. Ed. Bul. 24 (1923), pp. 32*).—Advance sheets from the survey noted above contain a brief note with reference to extension activities of agricultural and mechanical colleges, in which the work of the college of the University of Tennessee is described as typical.

Report of the committee on graduate studies, R. NEWTON (*Sci. Agr., 3 (1923), No. 11, pp. 389–393*).—Information was obtained by a committee of the Canadian Society of Technical Agriculturists in 1922–23 as to the status of graduate instruction in agriculture in Canada, and a summary is presented here of the organization, courses, and general requirements in institutions offering advanced degrees in agriculture. The financial assistance available to graduate students and certain questions of policy are also discussed.

The agricultural institute at the University of Breslau, ZORN (*Illus. Landw. Ztg., 43 (1923), Nos. 16, pp. 127–129, figs. 4; 17, pp. 135–137, figs. 4*).—A description is given of the new buildings for this institution, first occupied in 1923. The various departments of the school are described by the respective directors.

[Agricultural education in Algeria], T. STEEG ([*Gouvt. Gén. Algérie*] *Exposé Situation Gén. Algérie, 1922, pp. 472–585*).—Annual reports are given relating to the agricultural schools and experimental farms in Algeria in 1922 along lines previously noted (E. S. R., 48, p. 192).

The Agricultural Institute of Algeria at Maison-Carrée (*Institut Agricole d'Algérie à Maison-Carrée-Alger* [*Algiers: Gouvt. Gén. Algérie, Dir. Agr., Com. et Colon.*]. *Paris: Libr. Vuibert, 1922, pp. 62, pls. 2*).—This is a handbook of information with respect to the teaching staff, courses offered, and dates of examinations at this institution.

Vocational education in China, C. Y. TANG (*Vocat. Ed. Mag., 1 (1923), No. 10, pp. 727–731*).—The National Association of Vocational Education was organized in China in 1916 and now has a paying membership of 4,000 persons. It has outlined a tentative program for the establishment of vocational courses in country, middle, lower normal, and high normal colleges, and of more vocational schools of elementary and middle grade.

Three types of agricultural schools now exist in China, including the primary agricultural school or the B grade agricultural school, the vocational middle

or the A grade agricultural school, and the agricultural college. The number, enrollment, and teachers in each are set forth.

Programs outlined for vocational agricultural education and for promoting trade, home economics, and industrial education include standardizing the system, training competent and proficient teachers and administrators and supervisors, determining the courses of study, providing plant and equipment and the minimum for maintenance, and determining methods of instruction.

Planning the farm course with the farmer, H. B. ALLEN (*Vocat. Ed. Mag., 1 (1923), No. 10, pp. 734, 735, fig. 1*).—A method of planning the course of study, which the author has used in conjunction with farm surveys, a study of soil maps, and interviews with representative farmers, is that of having groups of farmers actually assist in the planning of definite courses. Three good farmers were selected from different parts of the community and invited to aid in planning a practical course in crop growing. Each individual was naturally influenced by his own type of farming. From a discussion of all three outlines a composite was developed, and this became the basis for the year's work in farm crops. The course of study represented here includes fall, winter, and spring topics as submitted by one member of the committee.

A recitation in farm management, F. W. LATHROP (*Vocat. Ed. Mag., 1 (1923), No. 10, pp. 732–734, figs. 2*).—The problem for the lesson described was the making of farm labor more effective. A list of 12 conclusions on the subject is given as drawn up by the class. This recitation is held to have been noteworthy in that it offered opportunity for initiative, provision was made for motive, and the opportunity was given to organize subject matter. Furthermore, the pupils carried the burden, there was a constant recurrence to the home experiences of the students, they had a real interest in the scientific study of farm problems as evidenced by charts which they prepared, and the teacher made careful preparation and plans.

Report of committee on marketing education, A. LEITCH (*Sci. Agr., 3 (1923), No. 11, pp. 394–396*).—Replies to a questionnaire sent to presidents, principals, and deans of agricultural colleges received from 22 out of 27 colleges in the United States and 3 out of 7 Canadian colleges are summarized here by a committee of the Canadian Society of Technical Agriculturists. The conclusion is reached that instruction in principles and in those services not closely connected with the actual physical characteristics of the commodities, such as assembling, grading and standardizing, and packaging, should be given in the department of economics. All matters relating to organization, financing, and costs of these services are strictly subject matter of economics.

The foreign girl and the full-time home economics course in California, M. I. MURCHIE (*Vocat. Ed. Mag., 1 (1923), No. 10, pp. 760–762, figs. 3*).—A cottage in Oakland was renovated, furnished, and conducted by the girls studying home economics at the Garfield Junior High School, where a considerable percentage of the enrollment is of pupils of foreign-born, particularly Portuguese, parentage. The project was found to provide teaching material in individual and community economic and social problems, as well as in the preparation of foods and the care of the home.

The use of practice houses in the secondary schools of Pennsylvania, L. M. HARTMAN (*Vocat. Ed. Mag., 1 (1923), No. 10, pp. 765, 766, fig. 1*).—There are in operation 13 practice houses in various vocational home economics departments throughout the State. The means taken to acquire them are briefly noted.

The development of farm household management instruction in Belgium, M. BEAUFRETON (*Internatl. Rev. Agr. Econ. [Rome], n. ser., 1 (1923), No. 1, 37–49, pls. 3*).—Permanent and traveling schools, lectures, and teacher

training courses making up the complete system of household management instruction in Belgium are described in these pages. The State Higher Training Institute for Farm Household Management at Laeken is noted particularly.

Use of tests and measurements in home economics instruction, E. Conley (*Vocat. Ed. Mag., 1 (1923), No. 10, pp. 768, 769*).—Several sewing scales are noted.

Course in related arts for high schools, C. T. Bryden (*Vocat. Ed. Mag., 1 (1923), No. 10, pp. 762–765*).—A course is worked out here for high schools which can afford only a very limited amount of reference material. Color study and such problems as the book cover and poster are given, paralleling the clothing classes. The first semester covers the elements and principles of design, proportion and space division, spacing parallel lines, decoration on structural lines, concentration of interest, and patterns and pictures suitable for the home. The second covers costume design and house furnishing and decoration. A list of reference material is given.

MISCELLANEOUS.

Annual Report of Idaho Station, 1922, E. J. Iddings (*Idaho Sta. Bul. 131 (1923), pp. 71, fig. 1*).—This contains the organization list, a report of the director, and financial statements for the Federal funds for the fiscal year ended June 30, 1922, and for the remaining funds for the fiscal year ended December 31, 1922. The experimental work reported is for the most part abstracted elsewhere in this issue.

Annual Report of Iowa Station, 1922, C. F. Curtiss (*Iowa Sta. Rpt. 1922, pp. 64*).—This contains a report on the work of the station, including a financial statement for the fiscal year ended June 30, 1922. The experimental work recorded is for the most part abstracted elsewhere in this issue.

Thirty-sixth Annual Report of Nebraska Station, 1922, E. A. Burnett et al. (*Nebraska Sta. Rpt. 1922, pp. 96, figs. 10*).—This contains the organization list, a report of the work of the station, a report of the extension service of the college of agriculture, a financial statement for the fiscal year ended June 30, 1922, and a list of the publications of the station and extension service since their establishment. The experimental work reported is for the most part abstracted elsewhere in this issue.

A few facts about the station and its work (*New York State Sta., (1923), pp. [2]+23, figs. 22*).—The work of the station is described, and some of the results obtained are briefly recounted.

Forty-fifth Annual Report of North Carolina Station, 1922, B. W. Kilgore et al. (*North Carolina Sta. Rpt. 1922, pp. 88*).—This contains the organization list, a report of the director and heads of departments, and a financial statement for the fiscal year ended June 30, 1922. The experimental work is for the most part abstracted elsewhere in this issue.

County experiment farms in Ohio, annual reports for 1920 and 1921, C. W. Montgomery et al. (*Ohio Sta. Bul. 361 (1922), pp. 311–568, figs. 12*).—This contains reports for the nine county experiment farms in Ohio, including financial summaries, crop and labor statistics, farm work reports, data on the maintenance of soil fertility, variety comparisons, etc. The experimental work reported is for the most part abstracted elsewhere in this issue.

Monthly Bulletin of the Ohio Experiment Station (*Ohio Sta. Mo. Bul., 8 (1923), No. 7–8, pp. 97–128, figs. 2*).—This number contains, in addition to several articles abstracted elsewhere in this issue, the following: Shall We Grow Wheat? by C. G. Williams, and Registered and Certified Seed Wheat, by W. E. Hanger.

NOTES.

Michigan College.—J. W. Crist has been appointed assistant professor of horticulture beginning November 1.

University of Missouri.—Dr. Stratton D. Brooks was inaugurated president of the university November 16, the ceremonies being attended by representatives from 117 educational and other institutions of the country, including the U. S. Department of Agriculture and the Bureau of Education, and by a large body of alumni and friends of the university.

In his inaugural address Doctor Brooks emphasized the breadth of the university and its responsibilities to the public. He paid a high tribute to the work of the College of Agriculture, whose benefits are more easily realized in cash than those of some other branches. "If there is a farmer in Missouri who has not directly profited from the work of the College of Agriculture," he said, "it is because he will not avail himself of the information and assistance that the college offers"; and he declared that "each year the increased profit due directly and indirectly to the work of the College of Agriculture will amount to many times the cost of the whole university."

The importance of research was emphasized, and it was explained that back of every practical application lies a basis of theory and understanding which have been developed through patient investigation, some of which may, for the time being, not reveal its practical aspects. He referred also to the increasing need for specialists resulting from the growing complexity of civilization, and declared that "to whatever degree organized society finds use for specialists' ability, to that degree the university may wisely go in offering specialized training." But he cautioned that while these specialists must be extreme individualists they should not be unmindful of their relation to the organization which made their specializing possible, or their duty to humanity. In this connection he said: "It behooves the university graduate not to be overwhelmed by the tide of efficient service so specialized in one line of human endeavor as to shrivel his interest and sympathy in humanity itself."

To demonstrate that the purpose of education is to improve both the labor and the leisure of mankind was another duty laid upon the university. "To give a man more leisure but leave that leisure vacant would profit him but little"; hence the duty of the university is to broaden man's interests and appreciation and enjoyment of the highest and best.

Officers of the Association of Land-Grant Colleges.—The complete list of general officers elected at the Chicago meeting, noted editorially in this issue, is as follows: President, R. A. Pearson of Iowa; vice president, G. I. Christie of Rhode Island; secretary-treasurer, J. L. Hills of Vermont; and members of the executive committee, the president ex officio (chairman), W. B. Bizzell of Texas, W. M. Riggs of South Carolina, A. F. Woods of Maryland, A. R. Mann of New York, and F. B. Mumford of Missouri. Under an amendment to the constitution, these members will serve terms ranging from one to five years each, the exact duration for the various individuals to be determined at a future meeting of the committee.

For the various sections the officers are as follows: Agriculture, B. H. Crocheron of California, chairman; C. A. McCue of Delaware, vice chairman; and F. W. Peck of Minnesota, secretary; engineering, J. W. Votey of Vermont, chair-

man, and C. R. Jones of West Virginia, secretary; and home economics, Agnes E. Harris of Alabama, chairman, and Edith P. Chase of Pennsylvania, secretary. In the three subdivisions of the section of agriculture, W. C. Coffey of Minnesota and C. B. Waldron of North Dakota were chosen chairman and secretary, respectively, for that of resident teaching; W. C. Coffey and W. Newell of Florida for experiment station work; and H. C. Ramsower of Ohio and W. R. Perkins of Louisiana for extension work. The subsection of experiment station work returned to its former practice of also appointing a recording secretary, naming E. W. Allen of the Office of Experiment Stations for this position.

The changes in the standing committees were unusually numerous, President Edwards expressing his belief in the desirability of rotation of members as a general policy. J. H. Skinner of Indiana replaced W. C. Coffey of Minnesota on the committee on instruction in agriculture, home economics, and mechanic arts, and F. P. Anderson of Kentucky and B. Knapp of Oklahoma succeeded A. R. Mann of New York and W. M. Riggs of South Carolina on that on college organization and policy. E. A. Burnett of Nebraska was succeeded by H. G. Knight of West Virginia on the committee on experiment station organization and policy, and T. Bradlee of Vermont and K. L. Hatch of Wisconsin by H. J. Baker of New Jersey and W. H. Brokaw of Nebraska on that on extension organization and policy. On the committee on military organization and policy, H. L. Kent of New Mexico was appointed vice W. B. Bizzell of Texas. The station membership on the joint committees of the association and the Department of Agriculture was altered by the selection of B. L. Hartwell of Rhode Island in place of A. Atkinson of Montana for that on projects and correlation of research, and H. W. Mumford of Illinois vice W. A. Riley of Minnesota for that on publication of research.

Two special committees were also authorized. One of these is to consider the matter of industrial and engineering extension and consists of R. L. Sackett of Pennsylvania, A. A. Potter of Indiana, L. E. Reber of Wisconsin, H. L. Boardman of Maine, and R. K. Bliss of Iowa. The other is to report on institutional classification and rating and will comprise five members, one of whom is to be named by the Secretary of Agriculture and another by the Secretary of the Interior. The remaining members were selected by the executive committee, comprising R. D. Hetzel of New Hampshire for agriculture, W. M. Riggs of South Carolina for engineering, and Miss A. L. Marlatt of Wisconsin for home economics.

W. J. Kerr of Oregon was appointed to represent the association on the American Council of Education for three years and President Hetzel on the council's committee of standardization. A. F. Woods of Maryland was appointed to the National Council of Research for one year.

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EXPERIMENT STATION RECORD.

VOL. 49. ABSTRACT NUMBER. No. 9.

RECENT WORK IN AGRICULTURAL SCIENCE.

AGRICULTURAL CHEMISTRY—AGROTECHNY.

Fundamentals of organic and biological chemistry, T. G. PHILLIPS (*New York and London: D. Appleton & Co., 1923, pp. XI+260, figs. 14*).—This textbook for a college course in organic and biological chemistry to follow the usual course in elementary chemistry is designed primarily, as stated in the foreword by A. Vivian, for "the student who is not majoring in chemistry, but who needs some knowledge of chemistry to enable him to understand certain other facts and principles which are fundamental to his major science or to his chosen vocation. In this small book will be found those facts and principles of organic and biological chemistry that should be known by all students of those sciences which deal with plant or animal life."

The first 11 chapters are devoted to a systematic development of the saturated compounds of the aliphatic series, with a chapter on unsaturated and aromatic compounds. The last 3 chapters are of a more general nature, dealing, respectively, with the general chemistry of living organisms, the chemistry of plants, and the chemistry of animals.

It is stated that the text as presented has been in successful use for 14 years at the Ohio State University.

Chemistry applied to home and community, P. G. BEERY (*Philadelphia and London: J. B. Lippincott Co., 1923, pp. XVI+534, figs. 85*).—This volume comprises a textbook and laboratory manual of applied chemistry, the subject matter of which has been collected (1) "to present such parts of the science of chemistry as would prove useful as a foundation for subsequent college courses of a practical nature offered to women, such as, for example, nutrition, cookery, industrial art, textiles, applied art, housewifery, etc., and (2) to present chemical subject matter which, in itself, has a direct application to the problems of a woman's life." The work is based on a previous knowledge of both inorganic and organic chemistry, although for the benefit of those students who have had no training in the latter a brief outline of systematic organic chemistry is included as an appendix.

The various topics considered include the chemistry of fuels, means of preventing and extinguishing fires; water; waste disposal; cleaning and polishing agents; stain removal; textiles; dyes; cellulose industries; paints and varnishes; the silicate industries; toilet preparations; foods, including separate chapters on the chemistry of carbohydrates, fats, and proteins, some newer phases of the food problem, and the chemistry involved in certain cooking processes; and drugs. Each chapter contains a discussion of the subject matter, appropriate laboratory exercises, review questions, topics for additional consideration, topics for posters, and a bibliography.

Note on the purification and precipitation of casein, J. H. Northrop (*Jour. Gen. Physiol., 5 (1923), No. 6, pp. 749, 750*).—To obtain a product free from denatured casein in the preparation of casein by precipitation at its isoelectric point, the following technique is recommended:

Casein is first precipitated from milk as described by Van Slyke and Baker (E. S. R., 39, p. 801), except that it is not necessary to take unusual precautions in the addition of the acid. After washing the precipitate thoroughly to remove soluble salts, a 10-gm. portion is suspended in a liter of water and sufficient hydrochloric acid added to bring the H-ion concentration of the suspension to pH 2.5 to 3. The cloudy solution resulting is filtered through a hardened fluted paper, the filtration being repeated several times if necessary until the filtrate is perfectly clear. The filtrate is then adjusted to pH 4.7 by the addition of sodium hydroxid. The precipitated casein is filtered, washed several times with distilled water, and either dried with acetone or kept as a fine suspension under toluene. It is stated that casein prepared in this way gives an almost water-clear solution in either acid or alkali.

The serum proteins of milk, W. Grimmer, C. Kurtenacker, and R. Berg (*Biochem. Ztschr., 137 (1923), No. 4–6, pp. 465–483*).—This extensive study of the proteins of milk is summarized essentially as follows:

The serum proteins of milk are not completely precipitable by heat coagulation even under the most satisfactory conditions. By a slight alteration of the H-ion concentration through the addition of a small amount of acid or acid salts the precipitation can be brought to an optimum. The heating of milk so alters the protein content of the serum that on a second heating more of the serum proteins are precipitated. The residual nitrogen of milk serum after the complete precipitation of the proteins with tannic or phosphotungstic acid is practically constant at 0.028 per cent in the case of tannic and 0.027 per cent with phosphotungstic acid.

Through the heating of the serum the digestibility of the proteins contained therein is lowered. Whey proteins are less easily digested by protein-splitting enzyms than are the proteins of curd. The cleavage products formed from casein by the action of rennet for a short time are precipitable by heat, but not after the prolonged action of rennet.

The tryptophan content of milk serum lies between 0.012 and 0.021 per cent. In the filtrate from the tannic and phosphotungstic acid precipitation, tryptophan is no longer detectable. The tryptophan content of the serum formed by the action of rennet on casein is about the same as that of milk serum and higher that that of casein. Tryptophan determinations on the digestion product of the action of pancreatin on rennet serum show that the splitting off of tryptophan from the protein molecule runs parallel with that of the other amino acids.

A biochemical study of Pacific Coast salmon, with particular reference to the formation of indol and skatol during decomposition, R. W. Clough (*Wash. [State] Univ., Puget Sound Biol. Sta. Pubs., 3 (1922), No. 64–67, pp. 195–272, figs. 9*).—This report of an extensive investigation of spoilage in salmon, with particular reference to the formation of indol and skatol during decomposition, includes a brief description of the salmon canning industry on the Pacific Coast, an outline of the methods employed in the systematic examination of canned salmon for spoilage, and a review of the literature on the chemical composition of fish and the changes taking place in its decomposition. This is followed by a report of the author's experimental work dealing largely with the investigation of raw and canned salmon for the presence of indol and skatol, these substances appearing to be the most promising decomposition products to use as an index of spoilage.

In the five species of salmon examined, skatol was not found in any of the raw samples or in the experimental cans prepared from them, but was found in several commercial cans. Indol was found in small amounts in all of the raw samples after 48 hours' storage, but only three contained more than 1.5 mg. per 100 gm. The quantitative determination of indol in 544 commercial cans of salmon showed that, in general, when the above quantity of indol was found a considerable degree of decomposition had taken place. It is emphasized, however, that the absence of indol can not be taken as complete evidence that decomposition has not taken place. It is concluded that "although the determination of indol can not supplant odor and physical appearance in the examination of canned salmon, it is nevertheless of value and affords considerable information as to the previous history of the sample."

An extensive bibliography arranged chronologically is appended.

The purification of insulin and some of its properties, H. W. Dudley (*Biochem. Jour., 17 (1923), No. 3, pp. 376–390, fig. 1*).—A method is described for the purification of crude insulin by precipitating the active material with picric acid and converting the insoluble picrate into a soluble hydrochlorid by means of an alcoholic solution of hydrochloric acid. The yield of hydrochlorid is said to be approximately 6 per cent of the crude insulin or 1 gm. from 20 or 25 kg. of pancreas. The insulin as thus purified no longer gives a test for phosphates or organically-combined phosphorus, nor the Seliwanoff test for fructose, nor the trytophan test. It gives a positive Molisch test, the biuret reaction, and a marked reaction for organic sulphur. Whether the sulphur is present as cystin or some other organic sulphur-containing compound has not yet been determined, but it is not in an easily reducible form as in glutathione. It is relatively stable to acids, but is decomposed by alkalis. In acid solution it is readily adsorbed, but in faintly alkaline solution may be filtered through Berkefeld filters without appreciable loss.

The polysaccharids, H. Pringsheim (*Die Polysaccharide. Berlin: Julius Springer, 1923, 2. ed., rev. [and enl.], pp. V+234*).—In this revision of the volume previously noted (E. S. R., 45, p. 310), the literature on the subject has been covered through October, 1922.

The electrometric titration of acids and bases with an antimony indicator electrode, A. Uhl and W. Kestranek (*Monatsh. Chem., 44 (1923), No. 1–2, pp. 29–34*).—The authors suggest the use of an antimony electrode for the electrometric titration of acids and bases, describe the apparatus employed for the titration, and present data on the reliability of the method in the titration of inorganic and organic acids.

The colorimetric determination of H-ion concentration by the method of Michaelis with single-colored indicators, using inorganic standard solutions, I. M. Kolthoff (*Pharm. Weekbl., 60 (1923), No. 36, pp. 949–966*).—A critical study is reported of the method of Michaelis and Gyemant for determining H-ion concentration by the use of single-colored indicators (E. S. R., 45, p. 205). A table is given of the dissociation constants and the range of pH values of α-, β-, and γ-dinitrophenol, *p*-nitrophenol, *m*-nitrophenol, and phenolphthalein in different concentrations and at various temperatures. As standard solutions for comparison, the author recommends potassium chromate in varying concentrations for α-dinitrophenol and *p*-nitrophenol, and potassium dichromate for γ-dinitrophenol and *m*-nitrophenol.

A note on the estimation of the carbon content of solutions, J. Needham (*Biochem. Jour., 17 (1923), No. 3, pp. 431–434, fig. 1*).—The method described, which is said to be suitable for determining the carbon content of liquids containing less than 20 mg. of the carbon-containing substance per 100 cc., is

essentially a combustion from solution, a known volume of the liquid being evaporated in the receptacle in which the combustion is to take place.

Determination of organic matter in decomposition experiments with soil, K. A. BONDORFF and H. R. CHRISTENSEN (*Soil Sci., 15 (1923), No. 5, pp. 361–366*).—Investigations conducted in connection with the article noted on page 813 as to the possibility of a direct determination of mannite in soil extracts are briefly reported, which were conducted at the Statens Planteavls-Laboratorium, Lyngby, Denmark. These showed that the method hitherto used in determining organic substances in soil extracts is not entirely satisfactory, since the oxidation of the greatest amount of mannite able to appear did not occur quantitatively according to the equation $C_6H_{14}O_6+13O=6CO_2+7H_2O$.

A special investigation of this result showed that a very considerable surplus of potassium permanganate is necessary for a quantitative oxidation. A modified method for the determination of organic matter is recommended on this basis.

A method for the determination of "active" aluminum in acid soils, P. S. BURGESS (*Soil Sci., 15 (1923), No. 2, pp. 131–136*).—A brief report is given of an investigation of various methods of determining aluminum with a view to their application to the quantitative determination of active aluminum in soils (E. S. R., 39, p. 114). The method finally adopted is a modification of the Carnot aluminum phosphate method, with a technique similar to that described by Lundell and Knowles (E. S. R., 48, p. 503).

"The only points of difference between their method and ours are that they use macerated filter paper during the precipitation of the aluminum phosphate, and that prior to the first precipitation we boil with sodium thiosulphate to reduce the traces of ferric iron usually present in soil extracts. The small amounts of titanium ordinarily present in soils are not soluble in N/2 acetic acid."

The technique is described in detail, and a few selected data are given to show a correlation between the reactions of the soils studied, the amounts of aluminum as determined by this method, and the growth of plants known to be especially sensitive to acid soil conditions.

A new and simple method for the determination of protein in honey, O. LAXA (*Ann. Falsif., 16 (1923), No. 176, pp. 286–289*).—The author is of the opinion that in the precipitation of dextrin from honey by alcohol, as in the method of Browne (E. S. R., 19, p. 1058), the protein nitrogen is also precipitated and can be determined by drying the precipitate in the oven at 100° C., extracting the residue with a little water to determine the reducing sugars, and redrying and weighing the precipitate. A comparison of the method with the usual Kjeldahl method indicated that the new method can replace the Kjeldahl in the determination of true protein, but not of total nitrogenous material in honey.

Note on the coagulation of milk by acid, L. ANDERSON (*Faraday Soc. Trans., 19 (1923), No. 1, pp. 106–111*).—Evidence that casein is the protective agent for the fat globules of milk is presented as follows:

On the addition of an acid such as hydrochloric acid to milk of various dilutions, the casein is precipitated in amounts increasing with increasing amounts of acid until the maximum rate of settling occurs, at which point the amount of acid required is inversely proportional to the dilution of the milk. At higher concentrations of acid the casein dissolves and the fat globules which had been mechanically carried down with it rise to the surface. On microscopical examination these globules were found to remain uncoalesced after several hours even in the presence of N/10 hydrochloric acid or sodium hydroxid.

Emulsions of benzene and olive oil in casein solutions behave similiary to milk in the presence of acid and alkali. On freeing the globules of benzene, olive oil, or milk fat from excess protein and washing them repeatedly with distilled water, coalescence takes place rapidly. "If the analogy between the benzene and olive oil emulsions and the fat in milk be allowed, it would seem that absorbed casein is the protective agent for the globules of fat in milk."

The determination of phosphoric acid in milk and its application to the detection of watering, A. KLING and A. LASSIEUR (*Ann. Falsif., 16 (1923), No. 174, pp. 141–146*).—The authors have applied the method of Copaux for determining phosphoric acid (E. S. R., 46, p. 415) to the analysis of altered samples of milk in conjunction with nitrogen determinations. The sample is oxidized as in the Kjeldahl method, an aliquot is taken for the nitrogen determination, and another for the phosphoric acid determination according to a slight modification of the method of Copaux. Data are given on the use of the method with samples of known dilution.

Comparison of methods of reading cream tests, F. J. DOAN, J. N. FIELDS, and C. W. ENGLAND (*Jour. Dairy Sci., 6 (1923), No. 5, pp. 406–411*).—Ten samples of cream of varying fat content were subjected to the Babcock cream test, two portions of each sample being used. On completion of the test, the bottles were tempered for from 4 to 5 minutes at from 138 to 142° F. and read at this temperature, the readings being made to the bottom of the upper meniscus and to the extreme top of the upper meniscus. The bottles were then returned to the bath and retempered for 1 or 2 minutes, after which glymol colored with alkanet was added to one set and fat-saturated alcohol colored with alizarin to the other, and readings again made. A fifth set of figures was obtained by adding to the figures obtained by reading to the bottom of the upper meniscus one-third of the difference between this reading and the reading to the top of the meniscus.

The various figures compared with the results obtained by the Roese-Gottlieb method show that the method using glymol agrees most closely with the chemical determination. Reading to the bottom of the meniscus was next in order, the variations being +0.28 and +0.32 per cent, respectively. The other methods were all more than 0.5 per cent out of the way.

Determination of different acids in fruit juices and foodstuffs, G. JORGENSEN (*Ann. Falsif., 16 (1923), No. 174, pp. 153–167, fig. 1*).—Methods are given in detail for the determination in commercial fruit juices of boric, phosphoric, tartaric, citric, malic, oxalic, and benzoic acids and of free mineral acids in vinegar.

A simplified method of preparation of the Bezssonoff reagent for vitamin C and some polyphenols, N. BEZSSONOFF (*Biochem. Jour., 17 (1923), No. 3, pp. 420, 421*).—The technique for preparing the reagent proposed for detecting the presence of vitamin C (E. S. R., 46, p. 668) is described as follows:

To 36 gm. of sodium tungstate and 4 gm. of phosphomolybdic acid dissolved in 200 cc. of water at a temperature of 50° C. are added 5 cc. of 85 per cent phosphoric acid, followed by 10 cc. of concentrated sulphuric acid added drop by drop with constant stirring. The solution is evaporated slowly at a temperature of from 40 to 42° to about one-third of its volume. The remaining liquid is poured off from the yellow monoclinic crystals which have formed, and these are purified by washing with small volumes of distilled water until 1 drop of the wash water gives a blue coloration with a quinol solution or a brown yellow with a pyrogallol solution (1 in 1,000 in each case). The washed crystals are dried between filter paper and made into a 15 per cent solution in 5 per cent sulphuric acid. It is stated that, as thus prepared, the reagent can

be preserved for more than 2 months in colored glass bottles provided with either a ground glass or rubber stopper.

The influence of reaction on the oxidation of the antiscorbutic factor in lemon juice, S. S. ZILVA (*Biochem. Jour., 17 (1923), No. 3, pp. 410–415, figs. 3*).—In an attempt to correlate the effect of the reaction of the medium and of oxidation on the stability of vitamin C, decitrated lemon juice was adjusted to a pH value of from 6.6 to 6.8 and used as the standard for comparison with a similar product, in one case made alkaline with N NaOH to a pH value of about 12.12, and in the other made acid with citric acid to a pH value of from 2.2 to 2.4. Portions of the alkaline solution were allowed to stand for 24 hours under aerobic and strictly anaerobic conditions, while the acid solution was aerated for 1 or 2 hours at 100° C. and the neutral solution aerated for 1 hour at the same temperature. The alkaline solution was acidified with citric acid immediately before being tested, and all the preparations were tested on guinea pigs which had been for about 14 days on a scorbutic diet of oats and bran, supplemented by a daily ration of not more than 40 cc. of autoclaved milk.

As thus tested, the alkaline solution lost about 80 per cent of its antiscorbutic properties in 1 hour when exposed to air at room temperature, while a solution of the same reaction kept for 24 hours at room temperature in the absence of air showed no deterioration. There was no change in the H-ion concentration of the alkaline solution after 24 hours in the absence of air, but a slight increase when exposed to air.

The samples of acidified decitrated juice aerated for 1 and 2 hours afforded greater protection than the neutral juice aerated for 1 hour, thus showing that the acidity of the medium protects the vitamin from rapid destruction.

A note on the conservation of the potency of concentrated antiscorbutic preparations, S. S. ZILVA (*Biochem. Jour., 17 (1923), No. 3, pp. 416, 417*).—The conditions of inactivation of vitamin C noted above have been taken into consideration in the method described in this paper for the preservation of concentrated decitrated lemon juice. The concentrated product prepared in the usual way was acidified slightly and stored in an ordinary conical flask in an evacuated bell jar over alkaline pyrogallic acid and tested from time to time for its antiscorbutic properties. No loss in potency of the product could be observed after three months.

A criticism and modification of the MacLean blood sugar method, A. B. HASTINGS and A. HOPPING (*Soc. Expt. Biol. and Med. Proc., 20 (1923), No. 5, pp. 254–256*).—The authors report that in the use of the MacLean method of determining blood sugar (E. S. R., 41, p. 505) higher results are obtained with freshly drawn blood to which no coagulant has been added than with the same blood previously oxalated. A study of the factors involved led to the conclusion that the difference in results is due to a reaction in the presence of the oxalate between the colloidal iron used as the protein precipitant and the thiosulphate used for titration. On substituting phosphotungstic acid in place of the colloidal iron, comparable results were obtained with both oxalated and nonoxalated blood. The technique for the modified procedure is described, and a new table of equivalents for the conversion of cubic centimeters of N/100 $Na_2S_2O_3$ into milligrams of glucose is given.

The estimation of ammonia and urea in urine and other fluids, S. LEVY-SIMPSON and D. C. CARROLL (*Biochem. Jour., 17 (1923), No. 3, pp. 391–402, figs. 3*).—The method described is an application of the Foreman method of steam alcoholic distillation to separate volatile bases from amino acids (E. S. R., 44, p. 411).

The conditions under which ammonia can be completely distilled over before frothing occurs have been developed, and it is found that "with 90 per cent alcohol and 100 cc. total volume of fluid, any value of ammonia between 144.1 cc. (N/10 acid) and 0.395 cc. (N/50 acid) can be completely distilled over before frothing." The technique for the determination, which must be followed carefully if accurate results are to be obtained, is described in detail, and data are presented on its application to the determination of ammonia and urea in urine. It is stated that a complete determination of both may be made in 30 minutes, while a determination of ammonia alone may be made in 7 minutes.

An improved method for the determination of nicotin in tobacco and tobacco extracts, O. M. SHEDD (*Jour. Agr. Research [U. S.], 24 (1923), No. 11, pp. 961–970*).—The method described, which has been developed at the Kentucky Experiment Station, is said to combine the more desirable features of the Official Kissling and Chapin silico tungstic acid procedures (E. S. R., 25, p. 16), and to eliminate one undesirable feature of both, namely, the steam distillation. In place of this the powdered sample is treated with sufficient alcoholic sodium hydroxid solution to liberate the nicotin, followed in the case of extracts by enough pure powdered calcium carbonate to form a moist mass. The material is then mixed thoroughly, transferred to a suitable container in a Soxhlet extractor, and extracted with ether for 5 hours. The nicotin is recovered from the ether extract by successive shakings with cold dilute hydrochloric acid (1:4), the combined extracts are made up to volume, and an aliquot is taken for precipitation with silicotungstic acid as in the Official method.

The technique of the procedure is described in detail, with accompanying data on a comparison of the results obtained by the modified and the original Chapin methods. Better agreement between the two methods was obtained with extracts than with samples of tobacco. Special precautions found to be necessary with the steam distillation procedure are to "use the minimum amount of alkali necessary to liberate all the nicotin, keep the volume of liquid in the flask at about 15 to 25 cc. to facilitate the distillation of the nicotin, and continue the distillation until a few cubic centimeters of the distillate shows no opalescence when treated with a drop of dilute hydrochloric acid and a drop of silicotungstic acid."

It was found possible to determine nicotin satisfactorily in most tobacco extracts by direct precipitation without the preliminary ether extraction or steam distillation. This method was found, however, to be inapplicable to tobacco and a few extracts.

METEOROLOGY.

Agricultural meteorology as a field for investigation, A. D. HALL (*Internatl. Rev. Sci. and Pract. Agr. [Rome], n. ser., 1 (1923), No. 2, pp. 272–280; also in Agr. Gaz. Canada, 10 (1923), No. 6, pp. 572–575*).—Defining the field of agricultural meteorology broadly to be "ultimately to predict crop yields from the weather prevailing during their growth," the author traces the development of the subject beginning with the generalizations of Shaw, Hooker, Smith, Jacob, and Wallén (E. S. R., 16, p. 955; 19, p. 414; 35, p. 114; 36, p. 209; 42, p. 117), regarding the correlations of weather and crops and including Brückner's studies on sun spot periodicity and weather cycles, Douglass' correlations of rainfall with growth rings in sequoias (E. S. R., 42, p. 417), and Beveridge's correlations of market prices of grain with seasonal conditions of weather (E. S. R., 43, p. 416; 47, p. 719).

Contrasted with the correlation method, which "reveals the frequency with which one set of facts, facts in the nature of results, tends to be associated with another set of facts which may or may not be causative," is "the intensive study of a given crop in its response to the weather conditions under which it is growing, in order for example to ascertain the meteorological factors which are significant in its development." The difficulties of such investigations are pointed out. Still, the author believes "these difficulties can be overcome and, when working on a small scale, the weather factors may to a certain extent be controlled so as to reduce the experiment to a single variable," and intensive investigations of this kind may "lead to the further knowledge that is needed concerning the meteorological data to be obtained, in order to be of service in the study of crop production. It is uncertain whether those at present collected by meteorologists are such as have the most bearing upon the development of vegetation."

It is pointed out that most of the questions involved are those "upon which the plant physiolgist, working intensively upon the individual plant, must reach some conclusion before the investigator applying the method of correlation can know what meteorological data are necessary to him, as being casually connected with crop development. Some further consideration must also be given to the data for crop production, which the investigator of agricultural meterology has to use." It appears, therefore, that "the question of data is of prime importance in the still infant science of agricultural meteorology. It is a difficult subject in which for some time to come progress is not likely to be rapid, but for that progress above all investigation is necessary. The meteorologists are still in the main waiting for a lead from those concerned with the agricultural side of the problem, and that lead can hardly be forthcoming until further research has been carried out on the reaction of the crops to the various elements of weather."

Relation between drought and production, L. MALLET (*Prog. Agr. et Vitic. (Ed. l'Est-Centre), 44 (1923), No. 35, pp. 228–238, figs. 2*).—Data regarding the drought of 1923 in the region of Montpellier and those of preceding years (since 1839) are given, and used as a basis for correlating rainfall deficiency with grape production.

Hot waves, hot winds, and chinook winds in the United States, R. DeC. WARD (*Sci. Mo., 17 (1923), No. 2, pp. 146–167, figs. 2; abs. in Lit. Digest, 78 (1923), No. 9, pp. 25, 26, fig. 1*).—The nature, sources, causes, and economic and physiological effects of the hot waves characteristic of the central and eastern United States; the hot winds of the Great Plains region; and the chinook winds of the northwestern United States are discussed, with numerous references to the literature of the subject. It is shown that these phenomena have many critical physiological and economic effects, especially with reference to crops.

Hot waves may be expected from June to September but are, as a rule, most frequent and intense in July. When accompanied by drought, as is frequently the case, they do much damage, particularly if prolonged and occurring at a critical period in the growth of crops. However, they are not always injurious; for example, many cereals like corn are often benefited by high temperatures early in the summer. Among the factors contributing to the production of hot waves are "(1) the importation of air from southern latitudes, (2) effective cumulative warming of the earth's surface and of the lower layers of the atmosphere to a greater height than usual under the strong summer sun, day after day, unhindered by any general cloud-cover, the diurnal heating being in excess of the cooling by nocturnal radiation, and (3) a certain amount of dynamic heating of the descending air under the anticyclone."

Hot winds are most frequent in July and August but occur from June to September. "The excessive heat and dryness of these hot winds, which usually blow with considerable velocity, make them very injurious to all crops. . . . Fortunately [they] do not occur often in their greatest severity. Not only is moisture evaporated from the soil, but growing vegetation is literally dried out as it stands. If the hot winds happen to come at a critical period in the growth of a crop, they may cause heavy damage within a few hours." The causes of hot winds are not fully understood.

"The chinook is a warm and dry wind similar in all respects to the Swiss foehn" and due to the same causes. It sometimes causes extraordinarily rapid rise in temperature. "During the colder months, chinook winds are important factors in the local climates of the northwestern mountain States. They temper the severity of the winters, bringing welcome relief from the extreme cold. . . . But it is their extraordinary effect in melting and evaporating the snow which has attracted the most attention. It is impossible to overestimate their economic importance to the cattle interests. . . . The coming of a chinook at a critical period saves thousands of cattle from starvation and freezing."

Climatological data for the United States by sections (*U. S. Dept. Agr., Weather Bur. Climat. Data, 10 (1923), Nos. 5, pp. [189], pls. 4, fig. 1; 6, pp. [189], pls. 4, fig. 1*).—These numbers contain brief summaries and detailed tabular statements of climatological data for each State for May and June, 1923.

[**Meteorology of Kapuskasing, Ont.**], S. Ballantyne (*Canada Expt. Farms, Kapuskasing (Ont.) Sta. Rpt. Supt. 1922, pp. 5–17*).—Tables show the daily precipitation, monthly minimum and maximum temperature, and hours of sunshine at the experiment station at this place, which is at 49° 23′ N. latitude and 82° 29′ W. longitude, with an altitude of 720 ft., and is "about as far north as any farming is at present being done in northern Ontario." Data are given for 1922 with averages for the five years 1918–1922.

The average annual precipitation for the five years was 23.64 in., varying from 17.739 in. in 1918 to 37.68 in. in 1921. Almost half, 49.28 per cent, of the precipitation occurred during the growing season, May 1 to September 30.

The average mean temperature varied from —2.05° F. in January to 61.26° in July. The lowest temperature recorded at the station was —52° February 5, 1918, and January 24, 1920. The highest temperature recorded was 99° July 6, 1921. Temperature is in many cases the limiting factor in crop production, particularly as regards the more tender vegetables and late maturing field crops.

"Out of the total of 60 months covered in these records only 6 months were entirely free from frost. July is the month with the least frost, and even in it one frost occurred during the past five years." Four years out of the five, frosts occurred in June and also in August.

"The month of June has the greatest number of hours per day of sunshine with an average of 9.08 hours, while November has the least with an average of 1.58 hours. The smallest amount of sunshine recorded any one year was in 1922, when 1,680 hours were recorded. The greatest amount was in 1921, when 1,890 hours were registered. The average of the four years, 1919 to 1922, inclusive, is 1,767 hours per year."

Dates of commencement of the more important farm operations are given.

SOILS—FERTILIZERS.

The soils of Arkansas, M. Nelson, W. H. Sachs, and R. H. Austin (*Arkansas Sta. Bul. 187 (1923), pp. 3–83, pl. 1, figs. 24*).—This general survey of the soils of Arkansas presents the results of chemical analyses of the principal

soil types of the State, with particular reference to their content of fertility constituents. Physiographically, it is stated that the State is divided into what is called the hill section to the north and west and the lower lands to the east and south. Drainage is said to be excessive over much of the hill section, the run-off being rapid and much soil washing taking place. Throughout the lower lying lands, where there is little relief, the streams are said to be sluggish, and in many places the lands are inclined to be poorly drained.

A summary of the chemical analyses of the different soil types indicates that a large number of the soils of the State fall far short of the average with reference to their contents of nitrogen and phosphorus. There is apparently a wide variation in the potassium content of the different soils, those carrying the smallest amounts being found in the sandy lands of the Coastal Plain region and in the sandier lands of the hill section of the western part of the State.

Soil survey of Iowa.—Reports 25–28, W. H. STEVENSON, P. E. BROWN, ET AL. (*Iowa Sta. Soil Survey Rpts. 25 (1922), pp. 64, pl. 1, figs. 14; 26 (1922), pp. 56, pl. 1, figs. 11; 27 (1922), pp. 62, pl. 1, figs. 18; 28 (1922), pp. 63, pl. 1, figs. 14*).—These reports present analyses and greenhouse and field experiments to determine the composition, fertilizer requirements, and crop adaptations of the different soil types of the respective counties. The soils are grouped as drift, loess, terrace, swamp, and residual.

No. 25, Marshall County.—This is an area of 366,080 acres in central Iowa, lying partly in the Iowan drift and partly in the southern Iowa loess soil areas. The topography consists in general of three distinct divisions, which correspond rather closely with the areas covered by the Wisconsin, Iowan, and Kansan drifts. The first division is an area of imperfect drainage, the physiographic features of which include many depressions, sloughs, small knolls, and hills; the second division, which is fairly well drained, is characterized by a rather level surface, broken by small depressions and general elevations; and the third division, including more than four-fifths of the total area, consists of an eroded, nearly level plain. The drainage system of the county as a whole is said to be quite complete.

The loess soils cover 67.7 and the drift soils 19.8 per cent of the area. Including muck, 16 soil types of 12 series are mapped, of which the Tama silt loam loess soil covers 59.4 and the Carrington loam drift soil 10.2 per cent of the area. The soils of the county are said to be very largely acid and not very well supplied with organic matter and phosphorus. The nitrogen content of the soils is not strikingly low.

No. 26, Madison County.—This is an area of 360,320 acres in south-central Iowa, lying entirely in the southern Iowa loess area. In general, the uplands of the county are rolling to rough in topography, and apparently the topography as a whole is that of an eroded, originally rather level loess-covered plain. The natural drainage, with the exception of a few small areas, is good. The loess soils cover 63.7 and the drift soils 24.2 per cent of the area. Fifteen soil types of 12 series are mapped, of which the Tama silt loam loess soil covers 50.3 and the Shelby loam drift soil 19.9 per cent of the area. The soils of the county are said to be practically all acid, and many of them are poorly supplied with organic matter. The phosphorus content of all the soils is said to be low.

No. 27, Adair County.—This is an area of 366,720 acres in southeastern Iowa, lying partly in the southern Iowa loess and partly in the Missouri loess soil areas. The topography varies from fairly level to strongly rolling to steep. Most of the soils are said to be well drained. The loess soils cover 51.6 and the drift soils 37.9 per cent of the area. Nine soil types of

7 series are mapped, of which the Tama silt loam loess soil covers 50.4 and the Shelby loam drift soil 36.4 per cent of the area. All of the soils of the county are said to be acid in reaction, and most of them are said to be not particularly well supplied with either organic matter or phosphorus.

No. 28, Cedar County.—This is an area of 364,800 acres in eastern Iowa, lying partly in the Mississippi loess and partly in the Iowan drift soil areas. The uplands are said to consist of a broad loess-covered plain, the original surface of which has been modified to some extent by erosion. The general drainage system of the county is said to be quite adequate. The loess soils cover 81.5 and the drift soils 11.3 per cent of the area. Including meadow, 16 soil types of 11 series are mapped, of which the Muscatine, Tama, and Clinton silt loam loess soils and the Carrington silt loam drift soil cover 29.8, 26.3, 24.2, and 10.8 per cent of the area, respectively. Practically all of the soils in the county are said to be acid, and the contents of organic matter and phosphorus are said to be low.

Origin of "molkenboden," O. von Linstow (*Internatl. Mitt. Bodenk., 12 (1922), No. 3–6, pp. 173–179*).—Chemical studies of so-called molkenboden or bright colored white to greenish gray soils occurring in certain German forests are reported. These soils are impervious when dry, plastic when wet, and as sticky as very clayey soils. The results are taken to indicate that these soils are chemically modified loess loam soils.

Clay as an ampholyte, O. Arrhenius (*Jour. Amer. Chem. Soc., 44 (1922), No. 3, pp. 521–524, fig. 1*).—Studies conducted at Harvard University are reported which showed that clays of different origin and different reaction have the same iso-electric point, and that the curve obtained by plotting rate of settling against the H-ion concentration has the same course as that of gelatin. The clay acted as an amphoteric electrolyte and was able to combine with either acid or base. This was also shown by the buffer action of the clays. The result is considered to be of both theoretical and practical importance.

The amount and composition of the colloidal clay in soils, V. Novák and L. Smolík (*Kolloid Ztschr., 32 (1923), No. 5, pp. 338–343*).—Studies of two loess loam cultivated soils and of a clay soil deficient in humus and of clay shale origin, to determine the amount and composition of the colloidal clay content, are reported. These showed that the colloidal portion, inclusive of humus, in a weak ammoniacal dispersion medium probably amounts to more than 8 per cent. The inorganic colloidal portion amounts to as much as 5 per cent and probably more.

Complete analyses of three colloidal clays containing iron showed a relatively high content of alkalis and alkaline earths.

Some colloidal properties of pleistocene clays and their bearing on the chemical theory of the formation of the gumbotil, J. N. Pearce and L. B. Miller (*Jour. Phys. Chem., 26 (1922), No. 1, pp. 1–24*).—Studies conducted at the University of Iowa on some of the colloidal properties of the gumbotils and their related strata are reported. The results are taken to indicate that gumbotils, being the residua from the weathering and leaching of more or less similar igneous drift materials, are similar from whatever drifts or localities they are obtained.

A capillary phenomenon, H. Bechhold (*Kolloid Ztschr., 27 (1920), No. 5, pp. 229–233*).—Experiments with unglazed porcelain and with garden soil are reported. It was noted that these materials, especially the soil, when saturated with salt solutions contained the greater part of the salts in their outer layers after evaporation of the solutions from the surface, and practically no salts in the deeper layers. The mechanism of this phenomenon is not clear.

Further investigations on Bechhold's capillary phenomenon, W. Kra[illegible] (*Kolloid Ztschr., 28 (1921), No. 4, pp. 161–166*).—Studies undertaken to determine the underlying reasons for the occurrence of the capillary phenomenon in soils and other porous substances noted in the above are reported.

It was shown that evaporation is necessary for the accumulation of salt crystals in the surface layers of porous substances. The same accumulation occurred when concentrated solutions of salts were used. Drying occurred as described by Zsigmondy for the dehydration of silicic acid gel, that is, it took place at the surface and not gradually throughout. Thus the salt accumulated at the surface, and there was no gradient of concentration below the surface.

The addition of a hydrophile colloid such as gelatin to the salt solution prevented the surface accumulation of salts except at a higher temperature. Lowering of the temperature sufficiently to appreciably increase the viscosity of the solution prevented the salt accumulation and permitted its uniform distribution on drying.

Decreasing the wetting tendency of the inner surfaces of porous substances by coating with paraffin permitted a uniform distribution of salts throughout the interior of the substances on drying, although a slight concentration of salts occurred at the surface.

Salt accumulations were observed in the void spaces of gypsum on the surface of filter paper pressed between glass plates with about 1 cm. protruding, and on flat surfaces when the solution was placed thereon as a drop. In the last case it was necessary for the surface to be wetted by the drop of solution. It was further shown that this capillary phenomenon is independent of the dispersity of the dissolved salt.

Cultivation without a plow, B. Tacke (*Mitt. Deut. Landw. Gesell., 38 (1923), No. 17, pp. 234–236*).—The results of a series of experiments extending over several years to compare cultivation using a plow with cultivation without a plow, according to the so-called Jean method, are briefly reported. The experiments were conducted on reclaimed marsh soils, and the crops were peas, beets, barley, beans, rye, wheat, turnips, and oats. Where no plow was used cultivation was effected mainly by the use of a spring-tooth harrow.

In all except certain exceptional cases better results were obtained where a plow was used, and the conclusion is drawn that the Jean method of cultivation is not adapted to the marsh soils of northwest Germany.

Hysteresis of aqueous solutions of humus soils, H. Puchner (*Kolloid Ztschr., 26 (1920), No. 4, pp. 159–168, figs. 13*).—Further studies on the subject are reported (E. S. R., 43, p. 725). These showed that extracts made with boiling water from a peat containing lime were turbid and at first had an acid reaction, but later became clear and were alkaline to litmus. Changes occurred in the extracts with age, and differences occurred in the residues left after slow evaporation at different ages. The slow changes in the extracts were attributed not only to chemical and physical reactions of the materials of the extracts, but also to low forms of plant life, the growth formations of which were characteristic.

Energy requirements for nitrogen fixation by nodule bacteria in comparison to other nitrogen fixation possibilities and initial studies of the subject, F. Christiansen-Weniger (*Centbl. Bakt. [etc.], 2. Abt., 58 (1923), No. 1–3, pp. 41–66*).—A review is given of the results of work by others bearing on the subject, and studies are reported to determine the energy requirements of nodule bacteria during the process of the fixation of air nitrogen.

The energy requirements of nodule bacteria were not met by the increased assimilating powers of treated legumes. It was not possible to exclude the factor of growth acceleration in the case of plants treated with nitrogen.

The upper limits for the energy requirements of nodule bacteria in nitrogen fixation were established by this means, however. The results are taken to indicate that the eventual energy requirement of nodule bacteria is so small as to be unimportant. This is considered to be of special significance in connection with recent attempts to adapt nodule bacteria to crops other than legumes, and to indicate that their energy requirements will not react injuriously to such plants to any noteworthy extent.

It is further concluded that the process of nitrogen fixation by nodule bacteria is exothermic. In this connection an estimate of the energy requirements indicated that they were hardly sufficient to support the life activities of the bacteria, and that the requirements of nonsymbiotic bacteria were five times as great. It is considered probable, therefore, that nodule organisms are so constituted as to be able to transform some of the energy incident to an exothermic nitrogen-fixing process into life energy.

Influence of the absolute reaction of a soil upon its Azotobacter flora and nitrogen-fixing ability, P. L. GAINEY (*Jour. Agr. Research [U. S.], 24 (1923), No. 11, pp. 907–938, fig. 1*).—In continuation of work previously reported on the subject by the Kansas Experiment Station (E. S. R., 39, p. 723; 49, p. 722), data on 418 soils from widely varying localities and conditions are reported and discussed.

Seventy-five per cent of the soils were acid, 50 per cent were more acid than pH 6, and 50 per cent apparently did not contain Azotobacter. In general, the electrometric and colorimetric methods of determining the H-ion concentration of the soil solution agreed. A definite and very close correlation was established between the absolute reaction of the soil solution and the presence or absence of Azotobacter in the soil.

Very few soils more acid than indicated by an H-ion concentration of 1×10^{-5} contained Azotobacter, although this group of organisms was in most instances present in soil with a lower H-ion concentration. Since a very limiting H-ion concentration was found for pure cultures of Azotobacter in laboratory media, it is believed that the very close correlation existing between the reaction and the presence of Azotobacter indicates that the absolute reaction is of paramount importance, if not the actual limiting factor, in controlling the presence of this group of organisms in soils.

Influence of soil condition on bacterial life and changes in soil substance.—II, Ability of soil to break down mannite, H. R. CHRISTENSEN (*Soil Sci., 15 (1923), No. 5, pp. 329–360*).—The substance of this report has been previously noted from another source (E. S. R., 49, p. 118).

Studies on the toxic properties of soils, A. W. BLAIR and A. L. PRINCE (*Soil Sci., 15 (1923), No. 2, pp. 109–129, figs. 10*).—Studies conducted at the New Jersey Experiment Stations on the toxic properties of soils are reported.

The soils, which had become toxic through more or less abnormal treatment, were leached with distilled water and the leachings analyzed for soluble iron and aluminum and other constituents, and were also used as culture media for the growing of plants. In growing the plants, portions of the extract were used unmodified, and other portions were modified by the addition of soluble phosphates, lime water, and by adding ammonia, boiling, and filtering to remove soluble iron and aluminum. Normal soils were also extracted and the extracts used in comparison with those from the toxic soil.

The culture solution work indicated clearly that there is something in the extract from the toxic soil which interferes with the root development of plants. The extract from the normal soil gave normal root development, as did also the standard culture solution. Additions of sodium nitrate and small amounts of soluble phosphates to the extract from the toxic soil did not correct

the unfavorable condition to an appreciable extent. When the toxic extract was boiled with ammonium hydroxid, filtered, and a trace of iron and phosphoric acid added to the filtered solution, normal root and top growth were obtained.

That this improvement is not due entirely to the neutralizing of the acidity was indicated by the fact that the standard control solution which gave normal root growth had a pH value of approximately the same as that of the toxic extract. Aluminum sulphate, when added to normal culture solutions in amounts equivalent to and greater than the alumina present in the unmodified toxic extract, gave results similar to those with the unmodified extract. The pH values of the solutions were lowered by the addition of aluminum sulphate, but culture solutions brought to identically the same pH with sulphuric acid produced plants much healthier in appearance than the cultures receiving the aluminum sulphate treatment. These results are taken to strongly indicate that soluble aluminum is responsible in part at least for the unhealthy root development.

Vegetations tests carried out in small glazed earthenware pots gave results which, in a large measure, confirmed the culture solution results. In the pot tests, however, heavy applications of acid phosphate to the toxic soil resulted in a great improvement in growth even when the pH value was as low as 5. Small applications of soluble phosphates failed to give normal growth. Heavy applications of ground limestone and basic slag also gave good results.

When aluminum compounds were introduced without a basic material such as lime, the yields were reduced to less than those from the untreated soil, but in the presence of liberal applications of basic materials aluminum sulphate and aluminum nitrate did not appreciably lower the yields of dry matter as compared with those obtained from the use of basic materials without aluminum compounds. These results are also taken to indicate that soluble aluminum compounds probably constitute one of the causes of toxicity in soils, and that such toxicity may be largely overcome by heavy applications of soluble phosphates, or by the application of basic materials such as the different forms of lime and basic slag.

Buffer action of acid carbonate salts and its importance in forest soils, E. RAMANN (*Ztschr. Forst u. Jagdw., 54 (1922), No. 1, pp. 4–11*).—Data from numerous studies are summarized showing that the decomposition of soil silicates by free carbonic acid is markedly retarded and sometimes almost inhibited by acid carbonate salts. It is shown that the excessive action of free carbonic acid in mineral soils tends to set free an excess of nutritive bases in soluble form which are leached to the subsoil, depleting the surface soil. Thus the action of calcium carbonate in producing a neutral reaction and the buffer action of acid carbonate salts are concluded to be important, especially in soils rich in humus and decaying organic matter, in that they prevent the too rapid decomposition of the nutrient-bearing minerals and the consequent depletion of the surface soils in nutrient bases.

Experiments on forest soils with saplings and old trees to determine the fertilizing value of forest litter showed that where the litter was used extensively and for some time the old trees thrived, but the saplings failed. This is attributed to the leaching of the nutrient bases set free by the carbonic acid from litter decomposition to the subsoil surrounding the roots of the old trees, but beyond the reach of the sapling roots.

Experiments on the manuring of green crops, H. H. WILES (*Indian Tea Assoc., Sci. Dept. Quart. Jour., 1922, No. 1, pp. 22–32, pls. 2*).—This is a report of the fourth year of a series of experiments by Cooper previously noted (E. S. R., 45, p. 516).

Lime showed a residual effect in the fourth year and tended to maintain if not to increase, the fertility of all plats to which it was applied either alone or in combination with other manures. Magnesia showed a rapidly diminishing effect, and after the second year its value was always definitely inferior to that of lime. No further increase in fertility resulted in the fourth year from the use of phosphoric acid, but the residual effect, however, from applications of superphosphate was still sufficiently strong to maintain very large crop increases. Potash salts continued to show a marked beneficial influence after four years, this being especially so in the case of potasium nitrate, which in the fourth year produced greater increases in fertility than any other single fertilizer with the exception of ammonium sulphate.

The fertilizer experiment (pot and field experiments), E. A. MITSCHERLICH ET AL. (*Landw. Jahrb., 58 (1923), No. 1, pp. 125–158*).—This paper is apparently intended as a contribution to the knowledge of methods for determining the fertility requirements of soils. Both pot and field experiments with nitrogenous, phosphatic, and potassic fertilizers are reported, from which the so-called working factors for ammonium sulphate, sodium nitrate, superphosphate, and 40 per cent potash salt are deduced. A well-defined relation apparently existed between the results of field and pot experiments, especially with potash and phosphoric acid. It was found that where pot experiments indicated no fertilizer action, such action could not be detected in field experiments. The universal use of pot experiments for determining the fertilizer requirements of soils is recommended.

Organic phosphorus in soils, O. SCHREINER (*Jour. Amer. Soc. Agron., 15 (1923), No. 3, pp. 117–124, pl. 1, figs. 2*).—In a contribution from the U. S. D. A. Bureau of Plant Industry, attention is drawn to the existence of organic phosphorus in soils by describing the isolation of one definite organic compound containing it, namely, nucleic acid.

It is stated that organic phosphorus is continually being added to soils by the incorporation of green manures, stable manures, plant residues, and so-called organic ammoniates. Soil microorganisms are also said to contain nucleo-proteins. The decomposition of some of these complex phosphorus compounds is briefly considered, and the method used in the isolation of nucleic acid is described.

The results of studies on the effect of nucleic acid on plant growth are briefly presented, and point to the conclusion that the plant is decidedly influenced by nucleic acid in its development. This is taken to indicate that the organic phosphorus constituent in soils, as well as of manures and fertilizers, must be considered as an important growth-promoting substance.

Determining the phosphorus needs of soils, E. TRUOG (*Jour. Amer. Soc. Agron., 15 (1923), No. 3, pp. 110–117*).—In a contribution from the Wisconsin Experiment Station it is brought out that the use of the field plat method of determining the phosphorus needs of soils is greatly limited in a region like Wisconsin, owing to the natural variation in soils. A less expensive and more rapid chemical method of determining the total phosphorus content of soils which has been devised at the station is described, and a tentative table giving the minimum percentages of total phosphorus in soils deemed adequate for general farming in Wisconsin under different soil conditions is presented.

A preliminary note on the theory of phosphatic depletion in the soils of Bihar, A. and G. L. C. HOWARD (*Agr. Jour. India, 18 (1923), No. 2, pp. 148–154, pl. 1*).—Experiments are briefly reported the results of which showed that the theory advanced by others that the calcareous soils of north Bihar are deficient in available phosphate has little or no analytical basis. The results of preliminary studies suggest that the explanation for the erratic results obtained

with superphosphate as well as those with phosphate and green manuring, may be due to the effect of the superphosphate on the physical texture of the soil.

Where indigo was grown continuously for several years without phosphate, no evidence of inhibited growth due to lack of phosphate was observed. Where the total amount of phosphate in the soil was reduced and the aeration improved, the vegetative growth was increased over 30 per cent. Crop growth was also found to be better in alluvial soils deficient in phosphate than in soils exceedingly rich in available phosphate.

The opinion is expressed that the effect of superphosphate is due mainly to an alteration in the physical texture of the soil brought about by some constituent of the manure. To test this point the results with superphosphate were compared with those obtained from the use of very dilute sulphuric acid and sulphur on cotton. Sulphur and sulphuric acid gave better results than superphosphate, the best result being obtained with sulphur. It is considered also possible that the small amount of phosphate present in these soils is brought into solution by dilute acid and thus rendered more available. A plan for further study is briefly suggested.

Fertilizing value of disaggregated phosphate, J. Graftiau (*Bul. Soc. Chim. Belg., 31 (1922), No. 1, pp. 22–32*).—Pot experiments with oats and cabbage on clay soil mixed with white sand to compare so-called Supra phosphate with basic slag, superphosphate, Vesta phosphate, and precipitated bicalcium phosphate are reported.

The Supra phosphate is a disaggregated phosphate similar to the Vesta phosphate and is obtained by calcination in a rotating kiln of a mixture of calcareous phosphates with fluxing material. It contained 12.28 per cent of phosphoric acid soluble in ammonium citrate and 15.47 per cent soluble in mineral acids. The Vesta and Supra phosphates gave results with oats which were intermediate between those given by basic slag and superphosphate. Good results were also obtained with cabbage. This is taken to indicate the relatively high fertilizing value of these disaggregated phosphates, especially where the use of a basic fertilizer is desirable.

Tests of phosphatic fertilizers (*Ann. Serv. Bot. [Tunis], No. 1 (1920–1921), pp. 28–38*).—Plat tests with wheat to compare superphosphate, natural phosphate, and natural phosphate added with sulphur are reported, but the conclusion was drawn that the heterogeneity of the soil was so great as to introduce marked variations and nonuniformities in the results obtained.

Influence of potassic fertilizer on the development and composition of different cultivated crops, E. Godlewski (*Compt. Rend. Acad. Agr. France, 9 (1923), No. 14, pp. 404–414*).—The results obtained during four years of a series of experiments begun in 1901 are briefly summarized. These showed that crops which increased in yield on a soil deficient in potash contained a smaller percentage of potash in their dry matter and a greater percentage of other nutritive constituents, particularly lime and magnesia, than crops harvested from a soil rich in potash. This condition was more manifest in the straw than in the grain of grain crops. It is concluded that analyses of straw give the best indication of the amount of available potash in soil.

An abundance or deficiency of available potash in soil was indicated more positively by the composition of oats and beans than that of other cereals and legumes, and quite clearly by the potash content of the straw of cereals and legumes. This was more marked in the case of the legumes. In the case of an abundance of potash in the soil the potash content of the straw reached 2 per cent of the dry matter, while where there was a deficiency in the soil the straw potash content became as low as 0.5 per cent of the dry matter. A

deficiency of available potash in the soil produced a profound change in the proportions of potash, lime, and magnesia in the straw of cereals and legumes.

The percentage of nutritive constituents in crops depended not only on the abundance of these constituents existing in available form in the soil, but also on the atmospheric conditions during the growing season. The ratio of potash to nitrogen in the tubercles of potatoes was found to be characteristic of an abundance or deficiency of available potash in the soil, increasing with an abundance and decreasing with a deficiency.

Beans, potatoes, and peas showed the most marked reactions to potash fertilization, while other crops, especially the legumes, showed less marked reactions. Barley and wheat reacted more strongly than rye or oats. The benefits of potassic fertilization were found to vary from year to year with the atmospheric conditions.

It is concluded that crops grown on soils deficient in available potash may cause an uneconomical use of the other nutritive constituents to the end that a small crop may absorb more of these constituents from a soil deficient in potash than a large crop from a soil rich in potash.

Potash fertilization and the action of potash on barley, Weiss (*Wchnschr. Brau., 39 (1922), Nos. 33, pp. 189–191; 34, pp. 195–198; 35, pp. 203–206; 36, pp. 209–211, figs. 9*).—The results of a large number of experiments on the use of potash fertilizers on barley on heavy and light soils, following different crops and stable manuring, are summarized. These showed little difference in the effectiveness of potash fertilization on heavy and light soils and indicated its importance for barley, especially following root crops and in spite of the fact that the root crops had received heavy applications of stable manure.

The potash field in western Texas, G. R. Mansfield (*Indus. and Engin. Chem., 15 (1923), No. 5, pp. 494–497, figs. 2*).—A brief description of this field is given, together with a map and graphic data of test borings.

Use of some silicate rocks in potassic fertilizers, E. Monaco (*Staz. Sper. Agr. Ital., 55 (1922), No. 10–12, pp. 434–446*).—A brief summary of information is given on the distribution and extent of the potash-bearing silicate rocks in Italy, on their direct use as potassic fertilizers, and on their chemical treatment in the manufacture of fertilizers. Leucite is apparently the most important of these rocks, but mica, orthoclase, and nepheline have also shown some value as carriers of potassium. A bibliography is appended.

Leucite as a source of agricultural potash, V. Manvilli (*Coltivatore, 69 (1923), Nos. 3, pp. 85–88; 5, pp. 149–153*).—Plat experiments with grain to determine the value of leucite as a source of potash as compared with other potash salts such as potassium chlorid and sulphate are briefly reported.

The leucite gave about as good results as the potash salts with respect to both grain and straw, and it is concluded that it is as good a source of potash as the common German and Alsatian salts. The best results were obtained on soils well supplied with lime, while the results were not so good on sandy and clay soils. It showed a satisfactory residual action.

Comparative action of sylvinite and its components on the primary development of plants, P. Lesage (*Compt. Rend. Acad. Sci. [Paris], 175 (1922), No. 21, pp. 992–995*).—The results of studies with solution cultures and pot and plat cultures watered with solutions, using various soils and mixtures thereof, are reported. The purpose of these was to compare sylvinite with its principal components, potassium chlorid and sodium chlorid and mixtures thereof, as a fertilizer. Wheat, oats, and *Lepidium sativum* were the crops used.

The development of roots and stems was in all cases greater with sylvinite than with either potassium or sodium chlorid, or a combination of the two, in

the percentages in which they occur in sylvinite. The mixture of the two salts gave better results than either used singly. Better results still were secured when potassium, sodium, and magnesium chlorids and calcium sulphate were mixed in the proportions in which they occur in sylvinite, but these results were never quite so good as when the original sylvinite was used. These results are taken to indicate that the mixture of the four salts does not contain all of the active elements of the sylvinite used.

Importance of liming for soil and plant and the action of different forms of lime, O. ENGELS (*Mitt. Ver. Förd. Moorkult. Deut. Reiche, 40 (1922), Nos. 6, pp. 92–95; 8, pp. 192–195; 10, pp. 227–231; 11, pp. 240–245; 12, pp. 251–253; 13–14, pp. 265–268*).—The author presents a summary of the results of studies by himself and others on the importance of liming in soil management, with particular reference to the action of lime as a plant nutrient and to its influence upon the physical, chemical, and biological properties of both mineral and moor soils. The action of different forms of lime is also discussed, special attention being drawn to the value of marl.

Recent investigations on the oxidation of sulphur by microorganisms, J. G. LIPMAN (*Indus. and Engin. Chem., 15 (1923), No. 4, pp. 404, 405*).—In a contribution from the New Jersey Experiment Stations, a brief discussion is given of investigations on the properties and activities of the microorganism *Thiobacillus thiooxidans* and its use as a sulphur-oxidizing agent.

Peat litter and peat mull, F. RAHM (*Torfstreu und Torfmull. Berlin: Paul Parey, 1922, pp. VIII+309, figs. 34*).—This work is divided into three parts.

Part 1 has to do with the manufacture of peat litter and mull from peat and describes the physical, mechanical, and chemical properties of peat litter. Part 2 deals specifically with the use of peat litter in stables, where its high absorptive powers are considered to give it considerable advantage over other types of litter from the standpoints of the health and comfort of the animals, and the ultimate conservation of valuable manurial ingredients.

Part 3 deals with the use of peat mull primarily as a fertilizer filler, a fertilizer carrier, and as a fertilizer conserving material. Its uses as a filler for animal feeds and as a packing and insulating material are also discussed. An appendix is included, which gives information on the utilization of peat fibers and peat moss.

Latrine operation, with special reference to peat dust utilization, F. RAHM (*Gsndhts. Ingen., 46 (1923), No. 15, pp. 151–155*).—Data on the use of peat dust in latrines and privy vaults for the absorption of liquids and gases are summarized. It is shown that the peat not only effectively reduces the liquids, gases, and odors in latrines and privies, but that the mixture of peat and excrement yields a fertilizer which compares well with average stable manure. Experiments with cabbage, oats, and clover showed the peat-excrement fertilizer to be about as effective as stable manure, and in the case of cabbage both gave better results than a complete artificial fertilizer.

Data from various sources on the value of the peat excrement mixture in truck gardens and orchards confirmed the above results, and showed that this material tends to hasten the ripening of fruits.

Arkansas fertilizer bulletin, J. G. FERGUSON (*Ark. [Bur. Mines, Manfr., and Agr.] Fert. Bul., 1923, pp. 57, figs. 2*).—This bulletin contains general information on the selection, purchase, and use of fertilizers for Arkansas conditions, and presents the results of actual analyses and guaranties of 862 fertilizers and fertilizer materials collected for inspection in the State during 1922.

Commercial fertilizer regulation, O. KOLLMANN (*Handelsdüngerrecht. Berlin: Paul Parey, 1922, pp. VIII+352*).—This book summarizes the important features of the commercial fertilizer industry in Germany, and discusses the details of fertilizer regulation as prescribed by law.

AGRICULTURAL BOTANY.

Textbook of agricultural bacteriology, F. LÖHNIS and E. B. FRED (*New York and London: McGraw-Hill Book Co., Inc., 1923, pp. IX+283, pls. 10, figs. 66*).—This book is designed to give the reader an accurate and fairly complete view of the field of bacteriology as applied to agriculture. A considerable portion of the material was published in German in 1913 (E. S. R., 30, p. 631), but it has been reviewed and brought up to date. After an extended discussion of the fundamental facts the practical application of bacteriology to agriculture, especially in the fields of dairying, sewage disposal, barnyard manure, and soils, is given consideration.

The utilization of atmospheric nitrogen by Saccharomyces cerevisiae, E. I. FULMER (*Science, 57 (1923), No. 1483, pp. 645, 646*).—The author claims that yeast will grow continuously in a medium composed of sugar and varying amounts of disodium phosphate. It will also grow in an apparently good state of nutrition using atmospheric nitrogen as the sole source of that element, and it is thought that the benefits accruing from the aeration of yeast cultures may be due as much to the addition of nitrogen as of oxygen.

Symbiosis in plants, J. MAGROU (*Bul. Inst. Pasteur, 20 (1922), Nos. 5, pp. 169–183, figs. 4; 6, pp. 217–231, figs. 4*).—In a review, largely bibliographical, of other contributions as well as his own, the author deals with the questions which have arisen in considering symbiosis as regards its phases, relations, or results, including evaluation and such matters as tuberization.

On the nature of mitochrondria, I. E. WALLIN (*Amer. Jour. Anat., 30 (1922), Nos. 2, pp. 203–229, figs. 9; 4, pp. 451–471, figs. 9*).—The four sections of this report deal, respectively, with observations on mitochondria staining methods applied to bacteria, reactions of bacteria to chemical treatment, the demonstration of mitochondria by bacteriological methods, and a comparative study of the morphogenesis of root nodule bacteria and chloroplasts.

It is concluded there is no fundamental difference between the staining reactions of mitochondria and those of bacteria, or between the reactions of bacteria and those of mitochondria to certain chemicals that have been used in attempting to determine the chemical nature of mitochondria. The respective demonstration methods may be used interchangeably. Mitochondria vary in fragility, as do bacteria, and mitochondrial substance is apparently miscible with the cytoplasm of the host cell. The author further believes that the view of a bacterial nature of mitochondria is supported by such apparent facts and biological principles as similarity of form, staining reaction, chemical reactions, physical properties (fragility), and functional properties (synthesis). This view is in harmony with the principle of biological behavior as exemplified in the struggle for existence resulting in symbiosis, with known factors of evolution, with known factors of cell activity, with the principle of cell dependence, and with the principle of analogy (*Bacillus radicicola*, lichens).

After careful analysis, the author is convinced that no property of mitochondria has been recorded in the literature that is not equally applicable to bacteria.

From the evidence recorded in these studies, together with that found in mitochondrial literature, the author arrives definitely at the conclusion that

mitochondria are symbiotic bacteria in the cytoplasm of the cells of all higher organism whose symbiotic existence had its inception at the dawn of phylogenetic evolution. The conception embodied in this conclusion presupposes that the establishment of new symbiotic complexes is coexistent with the development of new species.

Investigations upon certain tumor-like formations in plants, C. O. JENSEN (*K. Vet. og Landbohøjsk. [Copenhagen], Aarsskr. 1918, pp. 91–143, pl. 1, figs. 17*).—Taking as a basis for conclusions in making comparisons between tumor-like plant formations and animal tumors, the more fundamental qualities of the latter (these being development from a restricted cell area and further independent growth, abnormal and independent proliferating power of the cells and their little differentiated or anaplastic character, with capability of the cells to displace or infiltrate into surrounding normal tissue), the author sought in these investigations to demonstrate, if possible, the existence of tumorous vegetable growths having like powers and tendencies. The investigations included as material the leaf nodosities which develop in *Echeveria carunculata* during growth. In this work available methods proved inadequate.

The nodosities on roots of the hybrid crucifer *Brassica campestris*×*B. napus* were studied. Transplanted to normal turnips or rutabagas, the tissue was not abnormally self-propagated.

Tissue transplanted from spontaneous beet tumors to sound beets succeeded for four generations and tumor production for three. *Bacterium tumefaciens* was not demonstrated from these artificial tumors. The implications of this fact are discussed.

The photosynthesis of plant products, I. M. HEILBRON (*Nature [London], 111 (1923), No. 2789, pp. 502–504*).—Giving the substance of lectures delivered at the Royal Institution, the author reviews the findings and views on the subject and notes deductions arising from the work in hand.

According to the views now put forward, it necessarily follows that, both in the case of the photosynthesis of carbohydrates and also in that of the photosynthesis of nitrogen products, the whole center of activity must be contained in the green leaf itself. As to the manner in which translocation is brought about, it is suggested that, as the synthesis of active hexoses takes place concurrently with the production of nitrogen compounds, the conditions are especially favorable for glucosid formation. In this way a method would be found for the easy removal of insoluble materials from the leaf.

The author emphasizes the point that in regard to work being carried out by Baly and himself the only claim is that they consider it by no means impossible to reproduce in the laboratory processes strictly analogous and directly comparable with those taking place in the plant. Photosynthesis is in the main the chemistry of one single substance—formaldehyde. The whole process is dependent on energy supplied from the sun and made available through the activity of chlorophyll.

The physiology of the ascent of sap, J. C. BOSE (*London, New York, and Calcutta: Longmans, Green & Co., 1923, pp. XV+277, figs. 95*).—"The ascent of sap has been the most elusive problem in plant physiology. The obscurity which has surrounded the subject has been in a great measure due to the lack of adequate means of detection and accurate measurement of the rate of ascent, of transpiration, of exudation, and their induced variations. Various types of automatic recorders of great sensitiveness and precision have been devised and are described in the present work, which have been of signal service in the investigations of which an account is here given.

"The result of these researches is to prove the existence of active pulsating cells throughout the length of the plant, in and from the absorbing root to the transpiring leaf. It is the pumping action of these cells that gives rise to the physiological conduction of sap, even in the absence of root pressure and transpiration; it also injects liquid into the xylem, setting up an intravascular pressure with the consequent mechanical transport of fluid.

"The situation of the active cells has been localized by means of the electric probe; the cellular pulsations concerned in the ascent of sap have been recorded by an automatic method. The invisible changes in the interior of the plant have thus been revealed, and the effect of the changes of the environment determined from the responsive variations in the pulse record.

"Other investigations are described which show that there are two distinct modes of intercommunication and interaction between distant organs in plants: (1) The transfer of matter, and (2) the transmission of motion. The first of these is brought about by the movement of sap, and the second by the excitatory nervous impulse. They give rise to two reflexes at a distance, the hydraulic reflex being antagonistic to the nervous reflex. There are, no doubt, many such reflexes corresponding to the various modes of stimulation. The complexity of the life movements is, in fact, the expression of the combined effects of concordant and antagonistic reflexes.

"The ascertained facts justify the important generalization of the unity of the physiological mechanism in plants and animals. Further investigation of the simpler life of plants may therefore be expected to lead to the solution of many intricate problems in animal life."

The effect of respiration upon the protein percentage of wheat, oats, and barley, F. W. McGinnis and G. S. Taylor (*Jour. Agr. Research* [*U. S.*], *24 (1923), No. 12, pp. 1041–1048*).—Some data are given derived from an investigation on the variation in protein in wheat, oats, and barley as affected by respiration.

The loss of carbohydrate material during the ripening of the wheat, oats, and barley grains is said to be considerable, the greater percentage of the loss occurring before the process of desiccation begins and while the grain still contains above 40 per cent moisture.

The protein composition of wheat, oats, and barley is said to be influenced to a marked degree by the loss of carbohydrate material during the ripening period. Factors other than respiration or in connection with this process are said to contribute very largely to the formation of high protein grains.

Note on the H-ion concentration of potato dextrose agar and a titration curve of this medium with lactic acid, E. F. Hopkins (*Phytopathology, 11 (1921), No. 12, pp. 491–494, fig. 1*).—It is claimed that the H-ion concentration of potato dextrose agar is easily determined colorimetrically, and is quite constant. The effect of lactic acid on the reaction of the medium is presented as a titration curve, and suggestions are made as to its application.

Convenient chambers for inoculation of plants where high humidity and moderate temperatures are required, A. F. Camp (*Phytopathology, 11 (1921), No. 12, pp. 510–512*).—Descriptions are given of chambers successfully used in artificial inoculations of citrus blast in California.

Evolution factors, J. P. Lotsy (*Genetica* [*The Hague*], *3 (1921), No. 5, pp. 442–480*).—Factors operative in evolution are discussed under the several heads, of uncertainty regrading the causes of evolution, origin of individuals from gametes, grouping of individuals, and the constitutional alterations of the gametes.

Charles Darwin's views on the influence of crossing, J. P. Lotsy (*Genetica* [*The Hague*], *3 (1921), No. 6, pp. 513–543*).—Discussion is given of

Darwin's views on crossing and selection during generations as a means of modifying old races and of forming new ones.

The law of homologous series in variation, N. I. VAVILOV (*Jour. Genetics, 12 (1922), No. 1, pp. 47–89, pls. 2*).—"Parallelism in varietal polymorphism, and the existence of regularity in differentiation of greater groups as Linneons, genera, and families, is a great help in the study of varieties in self- and cross-fertilized plants and animals. . . . The existing systems of Linneons and varieties ought to be fundamentally changed and constructed according to a general plan. . . . The problem of the origin of species can not be separated from the problem of variation."

The occurrence of heteroploid varieties of Hyacinthus orientalis in Dutch cultures, W. E. DE MOL (*Genetica [The Hague], 3 (1921), Nos. 2, pp. 97–192; 3–4, pls. 14*).—An extended account of studies is followed by details and discussion of results and conclusions, with bibliography.

Heredity studies with beans, K. TJEBBES and H. N. KOOIMAN (*Genetica [The Hague], 3 (1921), No. 1, pp. 28–34*).—Of the two parts of this contribution, the first deals with a case of complete repulsion between the two factors indicated; the second with analysis of a spontaneous crossing between two bean varieties exhibiting a difference in growth habit which is said, as the result of the present study, to be due to a single factor.

Inheritance in the summer squash, E. W. SINNOTT and G. B. DURHAM (*Jour. Heredity, 13 (1922), No. 4, pp. 177–186, figs. 2*).—Self-fertile strains in the summer squash have been found and a number of pure lines established, from crosses between which information as to the inheritance of various plant characters has been gained.

In body color of fruit, white is dominant over yellow and yellow over green. There may be two independent factors for white, and there are evidently various modifying factors for color.

Habit of vine and shape and arrangement of leaves are clearly inherited, as also are, in the fruit, the number and character of teeth; type of border; furrowing of surface; certain characteristic shapes; size of seed cavity; size, shape, and color of seed; depth of blossom end scar; size of fruit; and yield; beside other characters. The exact manner of inheritance of all these, however, is not yet clearly established.

Degeneration in cultivated plants and inheritance of acquired characters, J. COSTANTIN (*Ann. Sci. Nat. Bot., 10. ser., 4 (1922), No. 5, pp. 267–297, figs. 2*).—Considerations which are presented with discussion in connection with degeneration in the potato, the effect of cold on the growth of evergreens, the inheritance of acquired characters, and the hereditary behavior of potato and of other cultivated plants lead up to the conclusion that the suppression of mycorrhiza has influenced profoundly the life habits of cultivated plants.

A cytological study of some Saccharum species and hybrids, G. BREMER (*Arch. Suikerindus. Nederland. Indië, Meded. Proefsta. Java-Suikerindus., 1922, No. 1, pp. 111, figs. 92*).—The study here presented in formal detail dealt chiefly with *S. officinarum*, *S. spontaneum*, the Indian varieties Chunnee and Ruckree, and hybrids.

The migration of principles in grafted plants, H. COLIN (*Min. Instr. Pub. [France], Bul. Off. Dir. Recherches Sci. et Indus. et Invent., No. 31 (1922), pp. 313–318*).—Citing, with discussion, related facts obtained from the work of others, also from his own work previously noted (E. S. R., 42, p. 226), the author points out instances of migration or retention of products in different parts of plants, including (as wholes) graft and stock.

The broad-sclerophyll vegetation of California: An ecological study of the chaparral and its related communities, W. S. COOPER (*Carnegie Inst.*

Wash. Pub. 319 (1922), pp. 124, pls. 21, figs. 43).—As to the scope of the present paper it is apparent that investigation has progressed more or less along the lines of taxonomy, ranges of species, range of type, its subdivisions, and relations to similar types in other regions, to climate, and to fire. The ecological character of the different species has been barely touched. This is true also of the mutual relations of vegetation and habitat, and the developmental phases of the problem have been treated only so far as fire is a factor in them. These subjects are also fundamental to a proper understanding of the economic relations of the species. The main emphasis in this paper is laid upon these subjects, though new material is offered along all the other lines mentioned, except taxonomy. The plan of treatment is to pass from the general to the specific. The first two chapters deal with phytogeographic relations, the next three with local units, their development and relation to habitat, and the last treats of the ecological character of the individual plant. An annotated list has been added as an appendix.

The field work was of the two usual sorts, intensive instrumental and quadrat study, and extensive exploration. The former was carried on mainly in the vicinity of Palo Alto from November, 1912, to September, 1915, and in the summers of 1916, 1917, and 1919. The exploration covered the whole extent of the Coast Ranges from San Diego to Eureka, and a number of representative localities in the Sierras.

FIELD CROPS.

Unavoidable error of field experiments, O. T. Faulkner (*Agr. Jour. India, 18 (1923), No. 3, pp. 238–248, figs. 6*).—From an analysis of the yields of wheat plats reported by Montgomery (E. S. R., 29, p. 38) and the yields from 1,000 orange trees by Batchelor and Reed (E. S. R., 38, p. 743), the author concludes that in general a considerably smaller standard error appears in comparing adjacent plats than in comparing plats taken at random, the errors in these two methods in both of the cases studied being about in the proportion of 2:3 when dealing with the original square unit plats. The error in comparing broad plats, those more than four or five times as broad as they are long, is, however, greater than in comparing plats made up of a similar number of scattered units. The errors in comparisons of adjacent long plats, and in comparing composite plats made up of scattered units, are similar in both cases when the number of units in the composite plats is as many as 10. With plats containing fewer units, the long adjacent plats are held better.

As regards increase of width without simultaneous increase of length, the minimum error is obtained with a plat of the width of 5 units, 110 ft. in the case of the fruit and 27.5 ft. with the wheat. An increase of length of plat without simultaneous increase of width throughout lessens the standard error of the comparison of the yields of adjacent plats. An increase of length of plat is much more effective than a corresponding increase of width, but a further increase in length beyond 5 units has not a greater additional effect.

In laying out plats so as to get from a given area of land results which shall be affected as little as possible by unavoidable errors, it is recommended that only adjacent plats be compared, that the width of each plat should be the minimum consistent with other considerations such as reducing the border effect to reasonable proportions, and that the length should be five times the width.

[**Forage crops investigations in Florida**], W. E. Stokes (*Florida Sta. Rpt. 1922, pp. 37–41*).—Studies of lawn and pasture grasses; seeding tests with

Bahia, carpet, and Dallis grasses and lespedeza; variety tests with saccharine and nonsaccharine sorghums; breeding work with Spanish peanuts and Napier and Merker grasses; and tests of cereal varieties for winter grazing crops, made in cooperation with the Office of Forage-Crop Investigations, U. S. D. A., are reported on briefly. Notes are included on the behavior and adaptation of newly introduced grasses, subterranean clover, Hubam sweet clover, mungo bean, and hairy, Augusta, and Oregon vetch.

[Report of field crops work in Louisiana, 1922], W. G. Taggart, A. F. Kidder, G. L. Tiebout, S. Stewart, et al. (*Louisiana Stas. Rpt. 1922, pp. 5–7, 15, 16, 21, 22, 27–34*).—Continuation of work similar to that reported earlier (E. S. R., 47, p. 427) is described.

In fertilizer tests at the Sugar Experiment Station a gain followed the use of 90 lbs. of potash per acre, and the ratio of suckers to stalks from planted buds again favored the use of potash. Application of the same amount of sulphur as carried in 90 lbs. of potassium sulphate, without potash, was not followed by increased cane yields. Where *Melilotus indica* was turned under March 2, 14.08 tons of cane per acre were produced and March 20, 16.36 tons, while cane receiving no clover made 10.46 tons, with a similar trend in the number of stalks per acre. Healthy seed of Purple and D–74 averaged 16.54 and 13.79 tons per acre, respectively, as compared with 15.78 and 9.54 tons from diseased seed. Selected strains have given increases of 2.52 tons with Purple, 3.42 with D–74, and 2.49 tons with L–511.

Results at Baton Rouge indicate that 2-year-old lespedeza meadows should be plowed and seeded to oats in the fall and reseeded to lespedeza in the spring. Biloxi and Mammoth Yellow soy beans gave the largest seed yields, while Otootan, Virginia, and Barchet varieties were better for hay. Corn and velvet beans planted in every row produced more corn and about as much velvet beans as when planted in every other row or two rows of corn and one row of beans. Early plantings of corn have given the highest yields and with less damage from insects and diseases. Certified Triumph seed potatoes from northern sources have markedly outyielded home-grown seed, and home-grown Triumph one year removed from northern-grown certified seed of the same strain did not approach new northern seed in yields.

Yields are tabulated from manured rotations and variety trials with corn, cotton, soy beans, and cowpeas at the North Louisiana Station.

[Field crops work on the Huntley, Mont., Reclamation Project Experiment Farm in 1921], D. Hansen (*U. S. Dept. Agr., Dept. Circ. 275 (1923), pp. 3–5, 7–14, fig. 1*).—Conditions on the project concerning crops are reviewed, and crop rotation experiments under irrigation by J. W. Bowen are reported on as heretofore (E. S. R., 46, p. 724). The average yields of field crops in different sequence in rotations and the results of investigations in dry-land agriculture by Seamans have been noted elsewhere (E. S. R., 49, p. 129).

During previous years all efforts to make silage of satisfactory quality from sunflowers at Huntley were unsuccessful, apparently due to a deficiency of fermentable sugar in the plants grown in the locality, since in other sections of the State, especially in the higher mountain valleys where sunflower silage of good quality was produced, the plants contained much more sugar. In an experiment in 1921 sunflowers and corn in equal proportions made silage of good quality, the corn apparently having enough sugar to cause proper fermentation in the mixture. The addition of 3 per cent of sugar in the form of sugar-beet molasses to sunflowers made silage of fairly good quality. Sugar added to sunflowers in other forms, such as sugar beets, also produced proper fermentation, resulting in silage of fair quality.

[Cooperative experiments with field crops in Ontario] (*Ontario Dept. Agr., Agr. and Expt. Union Ann. Rpt., 44 (1922), pp. 9–24, 29–38*).—Among the reports presented at the annual meeting of the Ontario Agricultural and Experimental Union at Guelph in January, 1923, were the Report of Co-operative Experiments in Field Husbandry for 1922, Including Tests of Cereal Grains, Potatoes, Roots and Fodder Crops, Hay Crops, etc., by W. J. Squirrell; Summary of Cooperative Experiments in Weed Eradication to 1922, by J. E. Howitt; and A Preliminary Weed Survey of the Province of Ontario, by H. Groh.

Field experiments, 1922 (*Seale-Hayne Agr. Col. Pamphlet 7 (1923), pp. 12*).—Comparisons at the Seale-Hayne (Devon) Agricultural College showed the superiority of potassium sulphate and chlorid to kainit for potatoes. The highest yields and market value were produced on plats treated with high-grade potassium chlorid, but differences were not observed in the culinary and storage qualities of tubers from the several plats. Ammonium chlorid gave results similar to ammonium sulphate as a top-dressing for wheat and as a nitrogenous fertilizer for potatoes.

Limited variety tests with potatoes, mangels, and oats are also reported.

Cereal experiments at Chico, Calif., V. H. Florell (*U. S. Dept. Agr. Bul 1172 (1923), pp. 34, figs. 5*).—Experiments with cereals made at the Plant Introduction Station, Chico, Calif., from 1910 to 1921, inclusive, comprised varietal and date of seeding trials with wheat, barley, oats, and flax, and breeding and classification studies with wheat. Agricultural and environmental conditions in the Sacramento Valley are described briefly, and climatic data secured at Chico are tabulated. Brief descriptions of the leading varieties of wheat (E. S. R., 44, p. 39), barley, and oats are included. On the average, high yields of wheat and barley, moderate yields of oats, and low yields of flax, emmer, and spelt were produced. The largest yields of these cereals usually are obtained from seedings made before December 31.

The soft and hard white common and the white spring club varieties of wheat appear to be best adapted to the Sacramento Valley, and a number of hard red spring common varieties of southern Asian and European origin also have produced well. The best average yields of wheat were obtained from Pacific Bluestem (White Australian) and Baart. Hard Federation, White Federation, and Federation are new promising varieties. Milling and baking data on 33 varieties of wheat showed that Hard Federation is superior in most milling and baking factors, except loaf volume, in which Baart excels. White Federation has a milling and baking value almost equal to that of Hard Federation. Bunyip had excellent milling and bread-making qualities in the year tested. Pacific Bluestem appears to be a fairly good bread-making wheat, with Federation slightly superior, while Sonora and Little Club are of inferior value.

Barleys best adapted to the region are the 6-rowed hulled sorts, particularly those of North African origin which include varieties of the Coast type. Coast, California Mariout, Club Mariout, and White Smyrna are leading varieties.

While oats are apparently not well adapted to the Sacramento Valley, Red Rustproof (California Red) and Fulghum have been among the best varieties. Emmer and spelt have not yielded as well as wheat or barley, and flax is not suited to the section. Grain sorghums, especially Dwarf milo, may be grown successfully.

Effect of reaction on growth, nodule formation, and calcium content of alfalfa, alsike clover, and red clover, O. C. Bryan (*Soil Sci., 15 (1923), No. 1, pp. 23–30, pls. 3*).—The effects of different reactions on alfalfa, alsike clover, and red clover were studied at the Wisconsin Experiment Station, supplementing an earlier investigation (E. S. R., 47, p. 434).

Alfalfa and clover seed germinated at reactions too acid or too alkaline for the growth of the seedlings. Very young alfalfa and clover seedlings appeared to be more sensitive to acidity and alkalinity than older plants. Red clover seed germinated and grew to a small extent at pH 4 but had difficulty in becoming established. It is stated that neither alfalfa nor alsike clover seedlings will establish themselves at pH 4, but the alsike does better at pH 5 and pH 6 than alfalfa and red clover. Alfalfa and clover produced maximum growth and number of nodules at pH 7 and pH 8, i. e., at neutrality or at a slight alkalinity. Alsike and red clover grew better in an acid reaction, pH 5 and pH 6, than alfalfa, and alsike clover withstood a very alkaline reaction even better than alfalfa. Nodules formed at any reaction at which the plants grew but were most profuse at or near neutrality.

The critical H-ion concentration differed slightly for the several plants studied, but in general was about pH 4. The critical acid concentration for red clover was somewhat higher than for alfalfa and alsike clover. The critical hydroxyl-ion concentration for alfalfa and red clover was about pH 9 and pH 10, while that for alsike clover was somewhat higher. The greater the acidity of the media in which the plants are grown, the less is the power of the plants to obtain calcium for metabolic processes. The author points out that the acidity found to be injurious to alfalfa, red clover, and alsike clover was not greater and was sometimes less than that noted in many acid soils.

Transplanting corn, A. MORETTINI (*Italia Agr., 59 (1922), No. 8, pp. 259–263*).—Experiments by the author indicate that growing corn by transplanting is technically possible, since the plants take root easily and a slight watering at transplanting insures the success of more than 90 per cent. The transplanted corn in the tests described had a greater root development than seeded plants, ripened about 10 days earlier, and gave a higher yield. However, the increased cost generally makes the practice undesirable except for skips or failures.

Heritable characters of maize.—XIII, Endosperm defects—sweet defective and flint defective, E. W. LINDSTROM (*Jour. Heredity, 14 (1923), No. 3, pp. 126–135, figs. 5*).—An endosperm defect in sweet corn called sweet defective which arose in an inbred Golden Bantam strain, has been proved to be inherited as a simple Mendelian recessive, according to this contribution from Iowa State College. What is considered to be a distinct mutant involving another endosperm defect, and which evidently could not have been in the stock in previous years, arose in the third inbred generation of the Golden Bantam strain. Another recessive endosperm defect, showing complete linkage with albino seedlings, was discovered in yellow flint corn.

The inheritance of defective seeds in maize, P. C. MANGELSDORF (*Jour. Heredity, 14 (1923), No. 3, pp. 119–125, figs. 5*).—Defective seeds, heritable variations in corn in which the endosperm is lacking or is incomplete or abnormal in its development, have appeared in all the so-called subspecies of corn with the possible exception of *Zea mays tunicata* and in more than 30 representative American varieties, as well as in several varieties from Spain and one from Peru. Genetic studies at the Connecticut State Experiment Station gave evidence that many different factors are involved which may cause defective seeds in corn. Characteristic types of defectives are described, which may be grouped as follows: Complete defectives, in which the development of the ovule is arrested shortly after fertilization; partial defectives, in which development proceeds until a certain amount of endosperm tissue has been deposited; and germinating seeds, in which the mature seed fails to go into the resting stage.

Investigations relative to the yielding capacity of oat varieties under different conditions of soil and climate, M. G. JONES (*Welsh Plant Breeding Sta., Aberystwyth, [Bul.], Ser. C, No. 3 (1921–22), pp. 5–45, figs. 9*).—Comparisons of standard winter and spring varieties of oats carried on by the Welsh Plant Breeding Station in 1921 and 1922 are presented, supplementing an earlier report by Stapledon (E. S. R., 45, p. 738). Detailed yield and agronomic data are recorded for the varieties studied, and the relations between the yield of straw and maturity, emergence of panicle, grain yield, and height of plants are discussed. Victory, Crown, Record, Radnorshire Sprig, Black Bell III, and Black Tartar are indicated in the order named for land of average productivity, the first three being also suggested for the best land and the latter three for soil of less than average fertility. Radnorshire Sprig, Black Bell III, Ceirch du Bach, and Welsh Strigosa may be used on the poorer soils.

R. G. Stapledon points out the necessity of classifying oats on a satisfactory agricultural basis and the relation of this classification to the conduct of variety trials and to the production of improved strains.

Grain sorghum experiments at the Woodward Field Station in Oklahoma, J. B. SIEGLINGER (*U. S. Dept. Agr. Bul. 1175 (1923), pp. 66, pls. 7, figs. 14*).—Yield and agronomic data obtained from varietal, date of seeding, and spacing experiments with grain sorghums during the period 1914 to 1921, inclusive, at the Woodward, Okla., Field Station, are tabulated and discussed, together with extensive meteorological notes and a description of the environment.

On the average, 70 per cent of the annual precipitation of about 24 in., occurs during the months from April to September, inclusive, which favors the production of annual summer growing crops, such as the sorghums. Low yields of sorghums are held due to periods of drought in July and August rather than to an annual or seasonal deficiency of rainfall.

Average acre yields during the 8-year period were as follows: Milo, Standard Yellow 22.8 bu., Standard White 19.7, Dwarf Yellow (C. I. 332) 21.2, Dwarf Yellow (C. I. 359) 21.8, and feterita 21.6; kafir, Blackhull 16.8, Dawn 23.8, Sunrise 26.3, White 17.5, White African 19.9, and Red 20.8; kaoliang, Blackhull 18.7, Manchu 13.4, and Valley 15.9; and shallu 15.4 bu. During five years darso has averaged 21.1 bu. of grain and Shrock sorghum 21.2 bu., while Dwarf hegari averaged 15.2 bu. during four years.

Date of seeding experiments indicate that Dwarf Yellow milo should be seeded in June, a mid-June seeding averaging highest with 33.4 bu. per acre. Sunrise kafir made its highest average yield from the mid-May seeding, with 27 bu. per acre. The data show that Dwarf milo seeded at the proper date will outyield Sunrise kafir when seeded at its best date. Dwarf Yellow milo in rows 44 in. apart made the highest average yield, 27.9 bu. per acre with 24 in. of row space to the plant. Sunrise kafir produced its highest average yield in 44-in. rows, 27.6 bu. with 12 in. of row space to the plant. The yields of both varieties in rows 88 in. apart were generally lower than with corresponding rates of seeding in rows 44 in. apart.

Sugar cane experiments, 1919–1921 and 1920–1922, J. DE VERTEUIL and L. A. BRUNTON (*Trinidad and Tobago Dept. Agr. Bul., 19 (1922), No. 4, pp. 188–214; 20 (1922), No. 2–4, pp. 65–109*).—Tests of seedlings and a comparison of sugar cane varieties (E. S. R., 45, p. 830) were continued in Trinidad during the periods indicated. The susceptibility to mosaic of the principal varieties of cane at the station is indicated, together with estimates in 1920 of losses in weight in the crop and in inferior quality of juice from diseased canes.

The best seedlings were obtained in 1919 from H? and L. 511, and in 1920 from Bourbon, H?, and M. P. 55. T. 718, T. 594, and T. 617 plant cane, with

5.97, 4.97, and 4.93 tons, respectively, of sucrose per acre in juice, led the new Trinidad varieties from seedlings raised in 1918, and T. 487 with 4.72 tons of sucrose, T. 496 with 4.26 tons, and T. 301 with 3.93 tons led the varieties from 1917 seedlings. B. 6388, Q. Badilla U., and B. 156, with 4.92, 4.82, and 4.61 tons of sucrose, respectively, were first among varieties from various sources.

A greater acre tonnage of cane was secured from each of eight varieties cultivated with animal-drawn implements than when cultivated by manual labor, but with one exception the juice was slightly better on the hand-worked plats. Better average yields of plant and ratoon canes were obtained where drains were 66 ft. apart than at 44 and 22 ft. distances.

[Experimental work with sugar cane in Queensland, 1922], H. T. Easterby (*Queensland Bur. Sugar Expt. Stas. Ann. Rpt., 22 (1922), pp. 1–52, 57–59*).—The progress of the cane sugar industry in Queensland in 1922 is described, together with tabulated field and analytical data on new and introduced varieties of sugar cane and the results of varietal, cultural, and fertilizer tests (E. S. R., 46, p. 836; 48, p. 631) at the sugar experimental stations at Mackay, South Johnstone, and Bundaberg.

Hungarian vetch, R. McKee and H. A. Schoth (*U. S. Dept. Agr. Bul. 1174 (1923), pp. 12, figs. 4*).—An account of Hungarian vetch (*Vicia pannonica*) with reference to its origin; botanical characteristics; environmental and cultural requirements; value for hay, green manure, and pasture; harvesting for hay and seed; and pests.

Hungarian vetch, a native of central and southern Europe, has been tested most extensively in the Pacific Coast States, where it is especially well adapted. In experimental tests in the Southern States it has done well except where affected by nematodes. Its winter hardiness, resistance to aphids, good seed habits, and adaptation to poorly drained lands make it desirable for extended trial throughout the Cotton Belt.

In cooperative experiments at the Oregon Experiment Station, locally grown seed of different years germinated well in all cases and retained its vitality with little or no decrease through a 5-year period. The largest seed yields, ranging from 1,450 to 2,700 lbs. per acre, have been obtained from fall seeding. The maximum yield in rate of seeding tests was from a rate of 80 lbs. of seed per acre. Planted with oats at different rates of seeding, the largest yield of vetch was produced from the seeding of 100 lbs. of vetch and 40 of oats. While observations on tripped and on bagged flowers indicate that Hungarian vetch is self-fertile and will set seed readily without the intervention of insects, it also seems apparent that the visitation of insects that trip the flowers results in increased seed production.

Experiments in wheat production on the dry lands of the western United States, D. E. Stephens, M. A. McCall, and A. F. Bracken (*U. S. Dept. Agr. Bul. 1173 (1923), pp. 60, figs. 24*).—Wheat is indicated as one of the most important farm crops grown in Washington, Oregon, Idaho, and Utah, and is the only important commercial crop grown on the nonirrigated lands. Successful dry-farm wheat production in these States is based on alternate years of crop and clean fallow. Experiments to determine the effect of different tillage methods on the yield of wheat, and tests on the rate, date, and depth of seeding wheat grown after fallow, beginning at Nephi, Utah, in 1904, at Moro, Oreg., in 1911, and at Lind, Wash., in 1916, were carried on in cooperation with the experiment stations of these States. Environmental conditions at each of the substations are described, and climatic data over considerable periods are tabulated and discussed. Much of the work at Moro has been detailed in earlier notes (E. S. R., 47, p. 533).

Fall disking of stubble land plowed early in the spring for fallow decreased yields of winter wheat at Moro, Lind, and Nephi. Disking stubble land in the spring before plowing increased yields at Moro and at Lind when the plowing was done as late as June 1, but did not increase yields when the plowing was completed by May 1. Yields of winter wheat after fall-plowed fallow when the stubble was burned and when different quantities of stubble were turned under were identical in a 6-year period at Nephi.

Early spring plowing (April 1) with 30 bu. per acre and late spring plowing (May 1) with 28.2 bu. returned the highest average yields of winter wheat at Moro. Late spring plowing (April) with 10.2 bu. and early spring plowing (March) with 10 bu. produced the best average yields of spring and winter wheat in a 4-year period at Lind. Turkey winter wheat at Nephi during the period from 1916 to 1921, inclusive, made its best averages from fall plowing with 24.5 bu. per acre and from early spring plowing with 24.2 bu.

Spring wheat and winter wheat plowed early in the spring 5 in. deep averaged 20.4 bu. per acre at Moro in 9 years, and plowed on the same dates 10 in. deep 21.3 bu. The yields from 4-in. dry fall plowing during 4 years at Lind were higher than from 6-in. dry fall plowing, while the yields from the two depths on wet fall plowing were identical. On early spring plowing (March) slightly better yields were obtained from an 8-in. depth. On plowing done in April and June the yields obtained from plowing 4, 6, and 8 in. deep were practically identical. At Nephi the average yield of winter wheat in 10 years on land plowed 10 in. deep was 1 bu. per acre greater than on land plowed 5 in. deep. The yields from 10-in plowing equaled those obtained from subsoiling 15 to 18 in. deep. Plowing in the fall and replowing in the spring did not increase winter wheat yields over those from one plowing.

Packing with surface or subsurface packers after plowing at Moro did not significantly increase yields of winter or spring wheat. On land plowed in early spring slightly higher yields were obtained at Lind during 4 years on land packed with a packer. On April plowing at Lind the yields also slightly favored plats packed after plowing, while on June-plowed plats the reverse was true.

Frequent cultivation of summer fallow at Moro resulted in higher average yields of winter wheat on fall-plowed land or on land plowed April 1 and May 1 than no cultivation of the fallow or one harrowing only. With plowing as late as June 1 cultivation of the summer fallow did not increase wheat yields. At Lind only slight differences were seen in the yields from the summer fallow receiving immediate tillage as compared with delayed tillage. More cultivation than needed to control weeds did not prove profitable at Nephi. Harrowing winter wheat in the spring reduced yields at Moro and at Lind, while at Nephi the average yield of winter wheat was not affected thereby.

Soil moisture and nitrate studies at Moro and Lind indicated that tillage practices have an important bearing on the accumulation of nitrate nitrogen in the soil. The quantity of nitrate nitrogen in the soil greatly influences the habit of growth of winter and spring wheat and the chemical composition of the wheat kernel.

Slightly higher yields were obtained at Moro from sowing winter wheat about the middle of September or early in October than on later dates, and the most profitable rate was 5 pk. per acre of treated seed, or about 1 bu. of dry seed. Early spring seeding at the rate of 5 pk. per acre gave the highest yields with spring wheat. At Lind early seedings of both winter and spring wheats gave better yields than later seedings, with about 4 pk. per acre as the most profitable rate. No advantage, however, was found in sowing wheat in

dry soil. At Nephi the highest average yields were obtained with winter wheat from the rates of 6 and 8 pk. per acre when these were the heaviest rates used. No significant difference was obtained at Moro during 4 years from winter wheat sown at 2, 3.5, and 5 in. deep. The depth of sowing winter wheat had an important influence on stand, especially when the seeding was late. At Lind an advantage accrued from shallow seeding winter wheat, but sowing spring wheat 4 in. deep gave slightly higher yields than sowing 1 and 2.5 in. deep. At Moro the same quantities of winter wheat sown in rows 7 in. apart produced higher acre yields than in rows 14 in. apart.

Michikoff wheat—a hard red winter wheat for Indiana, A. T. WIANCKO (*Indiana Sta. Circ. 112 (1923), pp. 4, figs. 2*).—Michikoff winter wheat was derived from a selection from a cross between Michigan Amber and Malakof, made by C. O. Cromer in June, 1912. Michikoff is a smooth, white-chaffed, short and stiff stemmed wheat with a rather small, compact head, which droops slightly when ripe. The kernel is short and plump, red in color, quite hard and glutinous, and is said to be of excellent milling quality. It is the only variety so far produced that has maintained a hard, red kernel under Indiana conditions. In yield and winter hardiness Michikoff ranks with the leaders and bids fair to replace most other varieties, at least on the dark colored soils of Indiana.

A study of factors affecting the nitrogen content of wheat and of the changes that occur during the development of wheat, G. A. OLSON (*Jour. Agr. Research [U. S.], 24 (1923), No. 11, pp. 939–953, figs. 2*).—Studies of the nitrogen content of wheat produced under various experimental conditions and of changes occurring during the development of wheat are reported from the Washington Experiment Station.

Increasing the distance between the rows seemed to increase the nitrogen content of wheat grown in the nursery without irrigation at Pullman, Wash., but did not appear to affect the nitrogen content under irrigated conditions at Grandview. Hybrid 143 when spring-seeded showed a higher percentage of nitrogen than when fall-seeded. The percentage of nitrogen in the kernel decreased as the grain matured. The nitrogen in the plant moved toward the kernel as the grain approached maturity. Irrigation did not affect the nitrogen content of wheat. Placing the wheat plant in water translocated nitrogen into the kernel. Wheat kernels showed little increase in weight after the moisture content dropped to 40 per cent, or the period of desiccation. Except in the early stages of development, phosphorus entered the grain simultaneously with nitrogen.

A summary of the milling and baking qualities of the various commercial classes of wheat for the crop years 1919–1922, J. H. SHOLLENBERGER and W. K. MARSHALL (*Amer. Miller, 51 (1923), No. 6, pp. 606, 607; also in Northwest. Miller, 134 (1923), No. 10, p. 1079*).—A comparison by class is given of the average results obtained from commercial samples of wheat tested by the milling and baking laboratory of the Bureau of Agricultural Economics, U. S. D. A., for the crops in the years indicated. Both the yearly and the 4-year averages are shown for each of the five commercial classes of wheat. The table following gives a summary of the results obtained.

Average results of milling and baking tests of commercial wheat samples from the crops of 1919 to 1922, inclusive.

Class of wheat.	Number of samples.	Test weight per bushel (dockage free).	Yield of straight flour.	Water absorption of flour.	Volume of loaf.	Color of crumb.	Texture of crumb.	Crude protein of wheat (N×5.7).	Ash of straight flour.
		Pounds.	*Per ct.*	*Per ct.*	*Cc.*	*Score.*	*Score.*	*Per ct.*	*Per ct.*
Hard red spring	242	57.5	69.4	57.9	2,181	88.5	89.2	12.3	0.50
Durum	39	61.4	72.3	61.2	2,025	86.4	92.1	12.7	.68
Hard red winter	285	58.7	72.6	58.4	2,150	89.9	90.4	11.6	.46
Soft red winter	211	58.6	70.3	55.0	2,075	89.7	90.3	10.7	.45
White	49	60.5	71.2	56.5	2,025	92.2	89.6	10.5	.44

Report of experimental work, State testing mill, crop season of 1921, C. H. BAILEY (*Minn. Dept. Agr. Bul. 23 (1923), pp. 37, figs. 8*).—The activities and equipment of the Minnesota State testing mill are described, with a report of investigations on the 1921 wheat crop.

Minnesota-grown spring wheats of the 1921-crop samples received from county agents were characterized by a somewhat shriveled condition, resulting in a low weight per bushel and a gluten content above the average, accompanied by an unusually hard or vitreous condition of the grain. These conditions combined to give a yield of flour below normal when the wheat was milled. The flour, however, was of fair color and somewhat superior in baking strength. Comparison is made between these data and similar studies during the crop seasons of 1911, 1912, and 1913 (E. S. R., 32, p. 159). The results obtained with Minnesota winter wheats were similar to those reported previously.

Car lots of different grades of dark northern spring wheat from several northwestern States were also studied. Milling tests indicated a fairly definite relation between yield of flour and weight per bushel, and although the flour produced from the lower grades of wheat was generally of satisfactory quality, the relative value of the wheat to the miller was reduced as the test weight diminished. Estimates based on market prices of products and on available milling costs indicate an average decrease in value of about 2 cts. per pound of test weight with wheat otherwise similar in character. Because of their superior gluten content, certain lots of wheat had a higher market value than other lots with a greater test weight.

Cleaning machinery removed most of the corn cockle seed and enough of the wild vetch so that the flour was not materially affected. Only a part of the kinghead, rye, and barley could be eliminated from the wheat.

Neither gain nor loss in milling was indicated when the wheat contained about 13.1 per cent of moisture. Based on the average price of wheat purchased ($1.434 per bushel), reducing the normal moisture content of wheat (13.5 per cent) 1 per cent appeared to increase its value to the testing mill a little more than 1 ct. per bushel.

Testing agricultural seeds, W. O. WHITCOMB (*Montana Sta. Circ. 114 (1923), pp. 17, figs. 10*).—The methods used in testing agricultural seeds at the Montana Grain Inspection Laboratory are described and illustrated, with instructions for sampling.

Hoary pepperwort or thanet weed, G. H. GARRAD (*Jour. Min. Agr. [Gt. Brit.], 30 (1923), No. 2, pp. 158–162*).—Experiments in the eradication of hoary

cress (*Lepidium draba*) showed the following sprays to be fairly effective in destroying the leaves and stems if applied when the plants are blooming: 40 lbs. of copper sulphate in 80 gal. of water, 2 cwt. of ammonium sulphate in 60 gal. of water, and 14 lbs. of copper sulphate and 56 lbs. of ammonium sulphate in 70 gal. of water. The plants should be hit with some force by the spray. The spray seems most effective on a dull, dry, sunless day and where the weeds stand well above the grain. Dusting was ineffective, and the sprays used in the test had no effect on bindweed or nettles and very little on poppies or thistles.

HORTICULTURE.

[Horticultural activities at the Canadian experimental stations] (*Canada Expt. Farms, Rpts. Supts. 1922, Scott (Sask.) Sta., pp. 51–67, figs. 3; Swift Current (Sask.) Sta., p. 15; Rosthern (Sask.) Sta., pp. 23–36, fig. 1; Lacombe (Alta.) Sta., pp. 61–86, figs. 2; Lethbridge (Alta.) Sta., pp. 42–55, fig. 1; Kapuskasing (Ont.) Sta., pp. 41–55; Lennoxville (Que.) Sta., pp. 21–31, fig. 1; Charlottetown (P. E. I.) Sta., pp. 26–39, fig. 1; Agassiz (B. C.) Farm, pp. 22–31, 34–42*).—These reports, respectively prepared by M. J. Tinline, J. G. Taggart, W. A. Munro, F. H. Reed, W. H. Fairfield, S. Ballantyne, J. A. McClary, J. A. Clark, and W. H. Hicks, contain general cultural and varietal notes on a large number of varieties of fruits, vegetables, and flowering plants.

[Horticultural investigations at the Sidney, B. C., Experimental Station], E. M. Straight (*Canada Expt. Farms, Sidney (B. C.) Sta. Rpt. Supt. 1922, pp. 7–41, figs. 2*).—In addition to general cultural notes on varieties of fruits, vegetables, flowers, and miscellaneous cultivated plants, there are presented data on orchard management studies in young orchards. Clean culture proved much more satisfactory than sod mulch. In fact trees in sod were so stunted in growth and bore such yellow vegetation as to indicate their early death, while those in tilled soil were vigorous, healthy, and making abundant growth. A test of fertilizers indicated that nitrate of soda has a marked tendency to increase the length of apple twig growth without materially affecting the diameter of the tree. On the other hand, in the pear nitrate of soda increased both trunk diameter and twig length.

Determinations of the net weight of green peas in pods of several garden varieties showed wide differences, ranging from 37 per cent in the case of American Wonder, Sutton Excelsior, Killarney, and Best of All to 53 per cent in the Merchant of Venice. It was found that freshly gathered peas shrink rapidly in weight when held in a warm situation even for a brief period. Muskmelon plants grown in cold frames ripened their fruit much more satisfactorily than did comparable uncovered plants.

Growing vegetables, R. L. Watts (*New York and London: Harper & Bros., 1923, pp. [6]+154, pls. 5, figs. 4*).—A handbook of practical information.

Sweet corn in the higher altitudes, H. Thornber (*Montana Sta. Bul. 157 (1923), pp. 19, figs. 3*).—Tests of sweet corn, data upon which are presented largely in tabular form, show that despite the cool nights prevailing in the high altitudes where the tests were conducted many of the varieties may, with proper cultural practices, be brought to satisfactory maturity. General cultural and marketing directions are presented.

Forecasting the date and duration of the best canning stage for sweet corn, C. O. Appleman (*Maryland Sta. Bul. 254 (1923), pp. 47–56, fig. 1*).—A popularization of material presented in a previously noted bulletin (E. S. R., 45, p. 134).

It is further emphasized that green sweet corn after attaining a prime canning condition deteriorates very rapidly in quality, quickly losing natural

flavor and succulence, characters which can not be restored by any addition of foreign materials such as sugar or starch. Based on temperature records in the field, a table is presented showing the number of days that sweet corn remains in a satisfactory condition at various mean daily temperatures ranging from 60 to 85° F. Chemical determinations, taken in connection with the more practical nail test method of determining maturity, indicated that the latter test is most reliable when applied to the late autumn crop, the changes in sugar and starch contents being much less rapid at this time than during the warm, midsummer period. Sweet corn requires very exacting attention during warm weather in order to determine the proper stage of maturity, and in many instances the average quality of the canned product could be greatly improved by so timing the crop that it would mature in late summer, a season whose cool nights tend to slow down the ripening rate.

Tomatoes as a truck crop, W. R. Beattie (*U. S. Dept. Agr., Farmers' Bul. 1338 (1923), pp. II+34, figs. 21*).—Practical information is presented relative to selection of soils, crop rotation, varieties, sources of seed, methods of starting early plants, construction and use of hotbeds and coldframes, growing plants, preparation of the soil, use of manures and fertilizers, planting, cultivation, irrigation, staking and pruning, combating insect and fungus pests, harvesting, and preparing for market.

Orchard cultural practices, H. Thornber (*Montana Sta. Bul. 156 (1923), pp. 19, figs. 6*).—This is for the most part a summary of previously noted reports (E. S. R., 47, p. 832) dealing with a long-continued soil management investigation in the Bitter Root Valley. The author again points out that clean culture may permanently injure apple trees and materially reduce their yielding capacities. Production and general welfare of apple orchards can not be maintained without resorting to some method of replenishing the supply of nitrogen and humus in the soil. Of two legumes utilized, namely, clover and peas, the former has proved the more satisfactory intercrop for orchards, being less expensive to grow and requiring less frequent irrigation. Furthermore, the trees among which peas were grown were more susceptible to fire blight injury, due probably to the strong vegetative growth induced by the large amount of water used in irrigating the peas.

Pot experiments on the manuring of fruit trees, T. Wallace (*Jour. Bath and West and South. Counties Soc., 5. ser., 17 (1922–23), pp. 168–183*).—Careful observation upon the effect of various combinations of nutrients upon the development of pot-grown apple, gooseberry, black currant, and strawberry plants showed that the complete nutrient solution was most beneficial in the case of all species tested. The omission of nitrogen from the nutrient solution caused a notable curtailment in the vigor of the plant and the quantity and quality of fruit. Omission of potash apparently had no significant effect. Phosphoric acid was evidently important in that its absence resulted in reduced vigor. Omission of calcium or magnesium had little effect. Plants supplied with rain water alone behaved very similarly to those receiving no nitrogen.

Factors governing fruit bud formation, V, VI, F. Summers (*Jour. Bath and West and South. Counties Soc., 5. ser., 17 (1922–23), pp. 140–149*).—Continuing the series of reports upon the general subject (E. S. R., 46, p. 38), two papers are here presented.

V. *Further experiments upon the ringing and notching of fruit trees* (pp. 140–144).—Data are here presented upon the effect upon bud development of ringing and notching of shoots of apple, pear, plum, and cherry trees. A slight and definite wound stimulus was observed when a shoot was notched or ringed in the vicinity of a bud. However, in rapidly developing buds this stimulus

was not sufficient to be noticeable and was apparently masked. Ringing lessened the water and food supply of the buds above the wound. Strong terminal buds apparently were better able to obtain a water supply from below a ring than were less vigorous buds.

VI. *The stimulation of bud growth in cuttings by inorganic and organic solutions* (pp. 145–149).—Enlarging upon the work of O. F. Curtis (E. S. R., 39, p. 826), the author forcibly injected solutions of saccharose, dextrose, levulose, and diastase, and plain tap water into apple cuttings. No evidence of retardation of bud development was observed in any case; in fact during the first 40 days the buds of all the treated cuttings were invariably more advanced than those of control cuttings. A tendency was noticed for the cuttings supplied with dextrose and levulose to show the strongest bud development in the internodes below the terminal three. On the other hand, in the saccharose-treated cuttings the terminal buds were invariably the strongest. In all cases there was a tendency for the basal buds to open first.

No stimulating effect was observed in cuttings in which potassium permanganate solution was injected. Phosphoric acid solution appeared to have a slightly stimulating effect upon the terminal buds. One-year-old shoots of Brayton Hall and Wolf River apples supplied by means of a hypodermic needle with a solution of 1 per cent of diastase developed the buds near the point of the injection with much more rapidity than terminal or any other buds on the cuttings. Furthermore, small shoots were produced from the treated buds. Since control shoots showed no increased growth at any of the buds, the diastase is thought to have acted upon the supply of reserve carbohydrates in the vicinity of the point of injection, thereby greatly increasing the supply of soluble nutrients. It is believed that not only the quantity of reserve carbohydrates near the growing point affects the development of the bud, but also the rate at which this material is made available by enzyms acting during the early stages of development.

Observations upon the date of fruit bud formation in various fruits, O. Kramer (*Deut. Obst u. Gemüsebau-Ztg., 69 (1923), No. 29, pp. 224–227, figs. 9*).—Data are presented on the time of fruit bud differentiation in 1922 for numerous varieties of pears, apples, cherries, plums, peaches, currants, and gooseberries.

Secondary flowering of the apple, C. G. Vinson (*Amer. Soc. Hort. Sci. Proc., 19 (1922), pp. 173–179*).—The occurrence in Pennsylvania in 1921 of a second crop of bloom on Smokehouse and Rambo apple trees and again in 1922 in Ohio on several apple varieties following the destruction of the first bloom by frost is noted. For the most part such flowers were borne on shoots produced from cluster bases from which the original clusters had abscissed. The question of the time of formation of flower primordia in these unseasonable blossoms is discussed.

Notes on a trial of gooseberries, E. A. Bunyard (*Jour. Pomol. and Hort. Sci., 3 (1923), No. 3, pp. 148–152*).—Observations taken during a 7-year period on a collection of approximately 250 varieties of gooseberries enable the author to present a classification of varieties based on color of fruit.

Report on Chaffey fertilizer experiments, C. J. Booth (*Calif. Citrogr., 8 (1923), No. 11, pp. 387, 397, figs. 2*).—Studies carried on over a period of years indicated that nitrogen is the limiting factor in crop production in a citrus orchard located at Ontario, Calif. Phosphorus and potassium, on the other hand, apparently failed to exert any influence on yield. Of four forms of commercial nitrogen-carrying materials, namely, sulphate of ammonia, cottonseed meal, tankage, and complete fertilizer, employed in the test, the first was the most successful, not only in respect to total yields but also in net

returns. As pointed out in an earlier report upon the same experiments (E. S. R., 48, p. 446), the use of excessive amounts of ammonium sulphate resulted in mottling injury. The mulching of a part of each plat with bean straw greatly increased the cost of nutrients without giving a proportionate increase in yield. In fact, at the end of seven years the mulched trees were no better than the unmulched, despite the fact that they had received mulch to the value of approximately $100 per acre. The largest percentage of first-grade fruit, 51.6, was produced on the cottonseed meal plat, with the ammonium sulphate plat second at 48.9 per cent. Analyses of fruit from the various plats showed no significant differences between treatments either in respect to time of maturity or the proportion of acid to sugar.

A quantitative test of fertilizer in an adjoining grove, in which 1, 2, and 3 lbs. of nitrogen were applied per tree at the approximate cost of $40, $80, and $120 per acre, showed the 2-lb. application to be most profitable. In general conclusion, the author points out that no one form of fertilizer has proved best, all materials increasing yield roughly in proportion to the amounts of nitrogen they contained. The use of any particular form is, therefore, dependent on cost.

Lemon production in the region east of Mount Etna, G. Savastano (*Ann. R. Staz. Sper. Agrumic e Fruttic. Acireale, 6 (1922), pp. 1–52, pls. 5*).—This is a general treatise relating to the history of the industry, the biology of the lemon flower, propagation, selection of sites, planting, pruning, culture, irrigation, the combating of insect and fungus pests, etc.

The smudging of mango trees and its effects, L. G. Gonzalez (*Philippine Agr., 12 (1923), No. 1, pp. 15–27*).—As a result of tests conducted by the College of Agriculture to determine the actual merits of smudging mango trees as a means of inducing earlier blossoming, it was found that flowering could be hastened provided a tree was in the proper stage of maturity at the time of treatment. By applying various amounts of heat to different trees it was found that the amount of bloom induced was directly proportional to the amount of heat applied. Smoke in itself had no apparent effect on blooming, but did clear the trees of leafhoppers, which, however, returned shortly after cessation of smudging. The most satisfactory period for smudging was found to be between the months of October and December. Success, however, was contingent upon settled weather, in that rainy conditions interfered with firing and also increased the susceptibility of the flowers and foliage to disease. Later smudging was unprofitable, as trees normally bloom about February. The best success was attained when the leaves were well matured and the terminal buds dormant and well formed. A prefatory note to the article is by J. E. Higgins.

Beautiful flowering shrubs, G. C. Nuttall (*London and New York: Cassell & Co., Ltd., [1922], pp. XII+280, pls. 40*).—This book, illustrated with full-sized color plates, presents popular information concerning the better known flowering shrubs of the garden.

A handbook on rose culture in India, R. Ledlie (*Calcutta: Thacker, Spink & Co., 1923, pp. IV+36, figs. 13*).—A presentation of popular information.

Propagation by cuttings in acidic media, J. Small (*Gard. Chron., 3. scr., 73 (1923), No. 1897, pp. 244, 245, figs. 3*).—Of five lots of rose cuttings placed in coconut fiber and watered with (1) cold water, (2) hot water, (3) cold dilute acetic acid 1–1,000, (4) cold dilute acetic acid 1–10,000, and (5) hot acetic acid 1–10,000, those in hot acid not only struck root first, but at the end of 6 weeks, when the other lots showed not more than 40 per cent of rooting, had rooted 80 per cent. In working with chrysanthemum cuttings, part placed in hot water and part in hot acetic acid, those in the hot acid

struck root more readily and successfully. Successful rooting was also obtained with cold acetic acid. In the case of privet and Veronica, not only did more cuttings root in the acid medium, but in many instances the root systems were much larger and healthier. The application of acid to ordinary garden soil aided materially in propagating *Antirrhinum* spp., *Calceolaria* spp., *Buddleia globosa*, *Hydrangea* sp., and others.

The forcing of carbon dioxid once a week for 4 weeks through water in which cuttings of *Aucuba japonica* were partly submerged caused such cuttings to callus and root, while a duplicate set in water supplied with air practically all failed. Similar favorable results were obtained with *Bryophyllum calycinum*.

The culture and propagation of the cactus and other succulent plants, W. O. Rother, rev. by A. Berger (*Praktischer Leitfaden für die Anzucht und Pflege der Kakteen und anderer Sukkulenten. Frankfort on the Odor, Germany: Trowitzsch & Sohn, 1923, 5. ed., pp. VIII+203, figs. 132*).—This is the fifth edition of this work.

Cassell's guide to gardening, H. H. Thomas et al. (*London and New York: Cassell & Co., Ltd., 1923, pp. IX+276, pls. 25*).—This comprises general information on the preparation and care of gardens.

The garden of earth, A. Giberne (*London: Soc. for Promoting Christian Knowledge; New York: Macmillan Co., 1921, pp. XIV+178, pl. 1, figs. 47*).—This book treats in a popular manner upon plant life, plant growth, and the ways and uses of plants.

Gardening for the twentieth century, C. Eley (*London: John Murray, 1923, pp. XIV+256, pls. 28*).—A popular discussion of gardening, with particular reference to plant materials.

Variety in the little garden, Mrs. F. King (*Boston: Atlantic Mo. Press, 1923, pp. [7]+120, pls. 9*).—This book comprises popular comments on the attractiveness and useful qualities of many species and varieties of garden plants.

Historic gardens of Virginia, E. D. T. Sale et al. (*Richmond, Va.: William Byrd Press, Inc., 1923, 2. ed., pp. 355, pls. 212*).—This book contains popular descriptions of notable Virginia gardens.

FORESTRY.

Trees, O. L. Sponsler (*Ann Arbor, Mich.: George Wahr, 1923, pp. XIII+158, figs. 71*).—A simple pocket guide for the quick identification of forest trees found in the region extending from Minnesota and Iowa eastward through Wisconsin, Illinois, Indiana, Michigan, and Ohio to the eastern parts of Pennsylvania and New York.

Northern trees in southern lands, E. H. Wilson (*Jour. Arnold Arboretum, 4 (1923), No. 2, pp. 61–90*).—On the basis of personal observations made during a recent tour through Australasia and South Africa, information is presented on the behavior of Northern Hemisphere forest trees in that region where, because of the natural scarcity of softwoods, the introduction of good quality, rapid growing species is a matter of great economic importance.

In general, introduced species of the genus Pinus have shown the greatest promise. *P. radiata* (*insignis*), native of California and considered of little value in its homeland, has proved a wonderful grower and producer in certain parts of New Zealand, Australia, and South Africa. *P. pinaster* and *P. pinea* grow successfully in the vicinity of Cape Town and Port Elizabeth, South Africa. *P. canariensis* thrives in Western Australia but has not been planted ex-

tensively. In South Africa *P. longifolia* has proved successful wherever summer rainfall is sufficient. *P. ponderosa*, next to *P. radiata*, is the most successful species at Macedon, near Melbourne.

The Douglas spruce shows promise in moist regions of Australia and New Zealand. The European larch grows exceptionally well on the mountain slopes in New Zealand. Species of the genera Picea, Abies, and Tsuga indicate little prospect of ever becoming important commercial assets. The redwood, although thriving in deep soils in many of the cooler parts of Australasia, is considered of value only for its beauty. Certain species of Cedrus and Cupressus were found to adapt themselves to favorable sites.

A large number of species of northern broadleaf trees have been planted in Australasia and South Africa, but have, with few exceptions, proved of little merit. *Salix babylonica* is described as the most beautiful and most flourishing northern tree in southeastern Australia. Hawthorns from northern Europe are widely used as hedge plants in New Zealand.

In concluding, a tabulated list is presented of the softwood species of value for the various sections of Australasia and South Africa.

Monograph on the chestnut, L. Piccioli (*Monografia del Castagno. Florence, Italy: G. Spinelli & Co., 1922, 2. ed., [rev. and enl.], pp. VIII+397, pl. 1, figs. 150*).—This book contains general information relative to morphological characters, varieties, culture, and control of insect and fungus enemies.

Poplars ([*Gr. Brit.*] *Forestry Comn. Bul. 5 (1923), pp. 55, pls. 4, figs. 13*).—This paper contains general silvicultural information regarding the poplars in Europe, including botanical descriptions, by A. Henry; a chapter on the character and uses of the timber, by W. H. Dallimore; a section on silviculture, by W. H. Guillebaud; protection against insect pests, by J. W. Munro; and fungus diseases, by W. E. Hiley.

The Elfin Forest of California, F. M. Fultz (*Los Angeles: Times-Mirror Press, 1923, pp. 267, figs. 123*).—A popular account of the dwarf woodland, or chaparral, which, with the exception of two desert areas, covers nearly all of southern California.

Trees and shrubs of Mexico (Oxalidaceae-Turneraceae), P. C. Standley (*U. S. Natl. Mus., Contrib. U. S. Natl. Herbarium, 23 (1923), pt. 3, pp. 517–848+XXVIII*).—This third installment of a previously noted work (E. S. R., 48, p. 43) deals with the families Oxalidaceae to Turneraceae.

The hardwood forests [of Western Australia], C. A. Gardner (*Aust. Forestry Jour., 6 (1923), No. 7, pp. 185–191, figs. 2*).—A brief article in which is discussed the forest situation in Western Australia, a territory comprising over 900,000 square miles. The eucalyptus family furnishes the most important timber trees.

Forestry for profit, W. M. Baker (*Trenton: N. J. Dept. Conserv. and Development, 1922, pp. 85, figs. 29*).—Following a brief statement regarding the present status of forestry in New Jersey, the principles and practices of forestry are presented in simple terms designed for the instruction of woodland owners. Supplementing the general text, several common species of forest trees are described, and their characters and uses discussed, and instructions are given for estimating timber.

Classification of thinnings ([*Indian*] *Forest Bul. 52 (1922), pp. 5, pls. 7*).—The various classes of thinnings approved by the Silvicultural Association, which met at Dehra Dun in January, 1922, are described and illustrated.

Report of the director of forestry for the fiscal year ended March 31, 1922, R. H. Campbell et al. (*Canada Dept. Int., Rpt. Dir. Forestry, 1922, pp. 48, figs. 12*).—This is the usual annual report (E. S. R., 47, p. 346) upon the

activities of the forestry branch of the Department of the Interior, enlarged by the addition of subreports from the chief of the tree-planting division the district forest inspectors for Manitoba, Saskatchewan, Alberta, and British Columbia, and the superintendent of the Forest Products Laboratories of Canada.

The use of airplanes for the detection of forest fires and for general patrol and survey work was continued with much success during the year.

Report of the commissioner of Canadian national parks for the year ending March 31, 1922, J. B. HARKIN ET AL. (*Canada Dept. Int., Rpt. Commr. Natl. Parks, 1922, pp. 52, figs. 16*).—The customary annual report (E. S. R., 48, p. 43) concerning activities during the year, including the construction of roads and trails, protection of forests from fires, etc.

Report of the forest branch of the Department of Lands, British Columbia, for the year ending December 31, 1922, T. D. PATTULLO, P. Z. CAVERHILL, ET AL. (*Brit. Columbia Dept. Lands, Forest Branch Rpt. 1922, pp. L 61, pls. 6, figs. 12*).—This report, like that of the preceding year (E. S. R., 47, p. 748), presents data concerning silvicultural operations, production of timber and timber products, fire prevention, etc. In addition, volume tables are presented for western yellow pine, western white pine, western hemlock, Douglas fir, Sitka spruce, and amabilis fir.

Forests and forestry in Ontario (*Toronto: Ontario Dept. Lands and Forests, 1923, pp. 20, pls. 4*).—A special report on forest resources and activities prepared by the Department of Lands and Forests, Toronto, for the information of the British Empire Forestry Conference held at Ottawa in July, 1923.

Afforestation in the United Provinces, India, E. BENSKIN (*Allahabad: Govt., 1922, pp. [3]+31+133A, pls. 23, figs. 2*).—This publication is designed to present in a brief manner the history of and methods of afforestation in the United Provinces, a territory where the forests have been recklessly exterminated for centuries and where systematic reforestation is peculiarly difficult on account of the irregular contour of the land and ignorance and opposition on the part of the native population.

DISEASES OF PLANTS.

Report of plant pathologist, O. F. BURGER (*Florida Sta. Rpt. 1922, pp. 45–55*).—Most of the research work conducted by the department is said to have been devoted to citrus diseases, especially melanose caused by *Phomopsis citri*. The relation of this fungus to stem-end rot is indicated. Spraying experiments showed that Bordeaux oil 3–3–50–1 gave good results.

An organism isolated from a citrus nursery that was badly infected with foot rot was studied and successfully inoculated into other trees, producing typical foot rot. The organisms that caused gumming of citrus trees were isolated, but inoculation experiments with them did not produce the typical lesions characteristic of field infections.

Brief accounts are given of a number of plant diseases observed during the year.

Report of assistant plant pathologist, W. B. TISDALE (*Florida Sta. Rpt 1922, pp. 68–75, figs. 5*).—The results are given of a survey of the tobacco district of Gadsden County, Fla., in which leaf spot (*Phyllosticta nicotianæ*), root knot (*Heterodera radicicola*), root rot (*Thielavia basicola*), and wildfire (*Bacterium tabacum*) are described as diseases occurring in seed beds and drowning (due to heavy rains), root knot, root rot, frog-eye spot (*Cercospora nicotianæ*), wildfire, and black shank as field diseases. Black shank is said to be the most serious disease of tobacco in this district.

Report of the Dominion Field Laboratory of Plant Pathology, St. Catharines, Ont., W. H. RANKIN (*Canada Expt. Farms, Div. Bot. Interim Rpt., 1921, pp. 67–93, fig. 1*).—In a previous abstract (E. S. R., 48, p. 449) an error appears. For the first paragraph the following should be substituted:

In the experiment on control by surgery of peach canker, four years' excision of cankers failed to give indication of promise. For the control of raspberry leaf curl, or yellows, the early and complete eradication of diseased bushes appears, for the present, to be the only hopeful method. Investigations by the author failed to reveal the cause of this disease, which appears to be distinct from mosaic. Leaf curl is believed to be infectious and is transmitted by insects or by root contact.

Plant pathology and chemotherapy, BEREND (*Angew. Bot., 3 (1921), pp. 241–253*).—Suggestions are given, with illustrations citing modern analogies in other fields, regarding the supposed possibility of employing widely the principles of chemotherapy in connection with plant diseases.

Pathological laboratory [report], WOLLENWEBER (*Mitt. Biol. Reichsanst. Land u. Forstw. No. 21 (1921), pp. 246–266, fig. 1*).—As divided, this report deals in part with loss due to potato diseases (*Verticillium alboatrum, Rhizoctonia solani,* and *Spondylocladium atrovirens*), temperature variation and extremes, control experiments with Spongospora scurf and Phytophthora rot, nematode (*Tylenchus devastatrix*) attack on potatoes, and injury due to certain other animals.

Report of the work done under the plant pathologist to Government of Bombay, Poona, for the year 1920–21, S. L. AJREKAR (*Bombay Dept. Agr. Ann. Rpt., 1920–21, pp. 121, 122*).—Investigational work for the period covered by this report as here summarized includes, besides insect injury, a smut of *Eleusine coracana,* one of *Panicum frumentaceum* due to *Ustilago paradoxa,* and one of milo due to *Sphacelotheca* (*Ustilago?*) *cruenta; Fusarium oxysporum* and *Oidiopsis* sp. in potato tubers; a threatening Macrosporium attacking onion; an undetermined leaf spot of sugar cane; a disease (*Synchytrium* sp.) of betel-vine leaves; and a die-back of camphor due to a Diplodia.

Seed treatment with Uspulun in Uruguay, A. BOERGER (*Angew. Bot., 3 (1921), pp. 321–350, fig. 1*).—Uspulun gave in most cases satisfactory seed disinfection and increased germination percentage, seedling vigor, and growth in wheat, cucurbits, and maize.

A new application of sulphur in plant culture, G. RUPPRECHT (*Angew. Bot., 3 (1921), pp. 253–262, figs. 8*).—A method for the use of sulphur as a fungicide employs the plan of subliming sulphur at high temperature. The particles as deposited are exceedingly fine and close together and oxidize with great readiness. Greatly enhanced adhesiveness is claimed besides other advantages.

Danger from parasites in volunteer plants, E. NOFFRAY (*Jour. Agr. Prat., n. ser., 39 (1923), No. 4, pp. 77–79*).—Fungi causing diseases of common economic plants are named and discussed in connection with their relations to wild and cultivated hosts.

Relations between smut spore content of seed grain and attack in the field, RIEHM (*Mitt. Biol. Reichsanst. Land u. Forstw. No. 21 (1921), pp. 49, 50*).—From artificial smut infections corresponding to a spore content of 0.4, 0.8, 1.6, and 3.2 per cent, the resulting smut infection percentages in the two sets of field tests were about in the same ratio (7.89 and 9.78, 16.25 and 16.96, 40.61 and 36.55), except for the last (31.28). The explanation for the exception is not apparent.

Helminthosporium on barley, RIEHM (*Mitt. Biol. Reichsanst. Land u. Forstw. No. 21 (1921), pp. 43–45*).—Barley leaf stripe and leaf spot outbreak during 1920 is discussed, with an account of attempts at control. These were not completely successful even when the seed were steeped for two hours in water at 45 to 48° C., and they were hardly at all effective when steeped at 52 to 56° for 10 minutes. Dry heat at 55 to 60° C. for 30 minutes seemed to increase the percentage of attack.

Tests of treatments against barley leaf stripe, RIEHM (*Mitt. Biol. Reichsanst. Land u. Forstw. No. 21 (1921), pp. 142–144*).—Tests with results (percentages of infection) are tabulated as made with formaldehyde, copper sulphate, corrosive sublimate, Uspulun, and Fusafine.

The cause of oat dry spot, [R.] SCHERPE (*Mitt. Biol. Reichsanst. Land u. Forstw. No. 21 (1921), pp. 112–115*).—A condensed summary is given of the principal data and conclusions appearing in a report of work carried on for some years on oat dry spot as noted from another source (E. S. R., 47, p. 542).

Injury done to oat leaves in consequence of nitrate assimilation, [R.] SCHERPE (*Mitt. Biol. Reichsanst. Land u. Forstw. No. 21 (1921), pp. 115, 116*).—Tests described suggest that root injury resulting in a loss or lowering of the function involving nitrate assimilation and the releasing of alkali in the leaves may result in abnormality culminating in such a form of injury as oat dry spot.

Biologic forms of Puccinia graminis on varieties of Avena spp., E. C. STAKMAN, M. N. LEVINE, and D. L. BAILEY (*Jour. Agr. Research [U. S.], 24 (1923), No. 12, pp. 1013–1018, pls. 4*).—The results are given of a study of about 100 collections of *P. graminis* on oats from various States of the United States, Provinces in Canada, Mexico, etc. Seventy-six of the collections were cultured and studied at the Minnesota Experiment Station.

As a result of the investigation it is claimed that there are at least four, and probably five, biologic forms of *P. graminis avenae* which produce different reactions on certain varieties of *Avena* spp. The newly discovered biologic forms are said to be as distinct as those reported of *P. graminis* on varieties of wheat.

Kind and degree of injury due to rye stem rust, SCHLUMBERGER (*Mitt. Biol. Reichsanst. Land u. Forstw. No. 21 (1921), pp. 60, 61*).—Tests under controlled conditions involving artificial infection of rye with the stem rust fungus (*Urocystis occulta*) show the unreliability of mere visual estimation of the severity of infection under field conditions.

Fusarium attack on wheats, L. DOYER (*Angew. Bot., 3 (1921), pp. 75–83*).—Observations on many wheat varieties regarding Fusarium attack are recorded as to species observed to occur alone or in connection with *Gibberella saubinetii*.

The mode of inheritance of resistance to Puccinia graminis with relation to seed color in crosses between varieties of durum wheat, J. B. HARRINGTON and O. S. AAMODT (*Jour. Agr. Research [U. S.], 24 (1923), No. 12, pp. 979–996, pls. 4*).—In order to determine whether the resistance to stem rust of two varieties of wheat, having different factors for resistance, may be combined in the progeny of their crosses, a study was made of the capabilities of two biologic strains of *P. graminis tritici* of infecting the progeny of crosses of three varieties of *Triticum durum*. Two of the varieties reacted reciprocally to two of the biologic forms used. Series of from 8 to 20 plants of the F_3 generations were used in the experiment, only the first leaves being inoculated with the different forms of the rust.

In respect to reaction to the rusts, some of the F_3 families were found to be as resistant as the resistant parent, others as susceptible, and still others were heterozygous. The results obtained with one biologic form on one series

of the crosses indicated the presence of two differential factors, while a single factor was indicated for other families and forms. No relation was found between seed color and rust resistance.

With the varieties of wheat used, it was found possible to combine, in a single variety, resistance to two biologic forms of stem rust of wheat, when crosses were made between two varieties which reacted reciprocally to these rust forms.

A study of rust resistance in a cross between Marquis and Kota wheats, H. K. Hayes and O. S. Aamodt (*Jour. Agr. Research [U. S.], 24 (1923), No. 12, pp. 997–1012, pls. 3*).—A study is reported of crosses between Kota and Marquis wheats made to determine whether the resistance of Kota is due to a single genetic factor, whether it is possible to produce a cross that would be resistant to two biologic forms, and to determine the possibility of using the reaction of F_3 seedlings in the greenhouse as a means of isolating F_3 families which have the resistance of the Kota parent. Two biologic forms of rust were employed in this experiment, a large number of inoculations being performed.

The results indicate that the factors for immunity and resistance contained in the parent varieties are dominant to a factor for susceptibility. The resistance and immunity to the two forms were combined in three F_3 families out of a total of 372 families studied. This is believed to indicate that resistance of one parent and the immunity of another can be combined in a single hybrid family. The results of greenhouse studies are said to show that such data can not be used to determine families which will exhibit types of resistance under field conditions.

Flag smut of wheat, W. H. Tisdale, G. H. Dungan, and C. E. Leighty (*U. S. Dept. Agr., Dept. Circ. 273 (1923), pp. 6, pls. 2*).—A popular description is given of flag smut of wheat, a more extended account of which has already been noted (E. S. R., 49, p. 343).

Estimation of smut spore content in wheat tests, Riehm (*Mitt. Biol. Reichsanst. Land u. Forstw. No. 21 (1921), pp. 45–49*).—Tests with the method of Bredemann (E. S. R., 26, p. 408) are outlined. The method worked out well in some practical tests indicated.

Tests of measures against wheat stinking smut, Riehm and Begemann (*Mitt. Biol. Reichsanst. Land u. Forstw. No. 21 (1921), pp. 137–141*).—In this work (the laboratory portion of which is reported by both authors, the field portion by Riehm) wheat stinking smut (*Tilletia tritici*) control was attempted in tests of treatments employing in all 12 different preparations. The methods and results of these tests are detailed.

Copper dust successful against stinking smut, G. H. Coons (*Michigan Sta. Quart. Bul., 6 (1923), No. 1, pp. 3–8, fig. 1*).—The dusting of seed wheat with copper carbonate and gypsum (18 per cent copper) or powdered copper sulphate and lime is recommended for the prevention of stinking smut.

Notes and studies on bush and pole beans, Pape (*Mitt. Biol. Reichsanst. Land u. Forstw. No. 21 (1921), pp. 28–31*).—Observations are recorded on attack by dry spot (*Gloeosporium lindemuthianum*), rust (*Uromyces appendiculatus*), and gray mold (*Botrytis cinerea*). Seed disinfection tests are noted as made with carbolic acid, Uspulun, formaldehyde, and corrosive sublimate.

[Bean seed disinfection tests], Riehm (*Mitt. Biol. Reichsanst. Land u. Forstw. No. 21 (1921), pp. 144–146*).—Treatments are recorded as made with Fusafine, Uspulun, and corrosive sublimate as against water treatment or no treatment for bean dry spot (*Gloeosporium lindemuthianum*). Mercuform was also tested. The results are tabulated.

Disinfection tests with beet seed, RIEHM (*Mitt. Biol. Reichsanst. Land u. Forstw. No. 21 (1921), pp. 146, 147*).—Details are given with tabulation of results in connection with disinfection tests applied to beet seed employing Uspulun, and several other proprietary preparations.

[Beet nematode control], BAUNACKE (*Mitt. Biol. Reichsanst. Land u. Forstw. No. 21 (1921), pp. 22–27*).—The brown resistant cysts with their supply of eggs or young, or both, constitute a strategic point as regards control in the life history of the beet nematode (*Heterodera schachtii*).

Stored maize attacked by Botrytis cinerea, PAPE (*Mitt. Biol. Reichsanst. Land u Forstw. No. 21 (1921), pp. 34–36, figs. 3*).—*B. cinerea* is shown to be an important cause of loss in growing maize largely by preventing germination in seed grains.

Bud and boll shedding, A. T. MCKILLOP (*Egypt Min. Agr., Cotton Research Bd. Ann. Rpt., 2 (1921), pp. 56–58*).—The most important work in this connection consisted in the keeping of a daily record of the flowering, shedding, and bolling of five wide-spaced Assili cotton plants surrounded by muslin catch nets during the period June 21 to September 28. By far the greatest amount of shedding was observed to occur at the stage of small buds 2 to 4 mm. in length. Shedding of squares and young bolls was of very secondary importance. Square shedding assumed important proportions during the periods September 3–5 and 16–22.

Examination of the curves for bud shedding, flowering, and bolling indicates that the shedding of small buds on any one day produces its maximum effect on the flowering curve exactly 15 days later. If a bud-development period of 22 days be assumed, it appears that practically the whole of the bud shedding in these plants took place in buds about 7 days old.

Slight evidence was obtained of a delay effect of irrigations on the flowering curve, the period being 16 to 18 days. No evidence was obtained of increased square or boll shedding consequent upon irrigations.

The final drop in the flowering curve occurred in the case of these plants on September 4. Much of this drop was due to previous bud and square shedding, but the data obtained show that the primary cause was a reduction in the number of buds laid down per day, which must have begun about August 13.

An attempt is being made to discover how far these results obtained from spaced plants are applicable to normal spacings and conditions.

Plants sown more than one month after the normal sowing date gave a flowering curve which was very late in rising. This lateness appears to have been due rather to very heavy shedding of small buds than to a delayed production of flower buds. Wide-spaced plants appear to show a higher degree of small bud shedding than closer-spaced ones. Plants normally watered show a higher degree of bud shedding and produce fewer flowers in the earlier stages than plants which are being grown with less than the normal supply. This throws an interesting light on the relations between early maturity and water supply.

Sore shin, A. T. MCKILLOP (*Egypt Min. Agr., Cotton Research Bd. Ann. Rpt., 2 (1921), pp. 58–65*).—During 1921 cotton mycological research was directed especially to the study of sore shin and its prevention. Experiments were intended to develop a method usable on a small scale on the Government experimental farms in cases where it is desired to grow as many plants as possible from seeds of special varieties, and also to find another method of control, cheap and easy, which would be usable on a large scale by cultivators.

The results of seed treatments with different chemicals to keep down sore shin, as given in tabular and descriptive detail, are not deemed very important. As to date of sowing, the best germination results were obtained

from sowings made March 20 and 31, as opposed to those made March 10. It is thought that if the dates of sowing had been spread over a longer period a much greater difference in germination would have been obtained between the early and late sowings.

The biology of Thielavia basicola, PETERS (*Mitt. Biol. Reichsanst. Land u. Forstw. No. 21 (1921), pp. 63–74*).—Study of *T. basicola* on *Lupinus* spp. shows the existence of two biological strains of the fungus, one attacking commonly *L. angustifolius* and occasionally *L. mutabilis* and *L. pilosus;* the other attacking in addition *L. albus* and *L. luteus.*

Result of investigations made by the Department of Agriculture, Burma, into the extent of the damage caused by Striga lutea, A. M. SAWYER (*Burma Dept. Agr. Bul. 18 (1921), pp. 7, pls. 5*).—This report gives a summary of information obtained during an investigation (1913–1920) regarding the prevalence, habits, and characteristics of *S. lutea* in the plains of Burma, the object being to discover a simple and inexpensive but effective means for reducing the losses caused by this parasite in connection with millet. The report, like the corresponding work, is in two parts, namely, a study of the plant and its parasitism and trials of means to check its spread. The latter, as presented in brief systematic form, include direct killings with chemicals and decoy cropping of the host. The first of these usually injured the host rather than the parasite, and the second, after giving promise in preliminary trials, proved disappointing when employed on a field scale.

Among the encouraging facts noted, it is stated that sowing in rows 18 in. apart, followed by occasional intercultivation with a wheel hoe, resulted in vigorous crops despite dense infestation. Thorough cultivation, drainage, manuring, and early sowing, which tend to produce tall, vigorous, and shady crops early in the season, minimize the loss. The burning of stubble and rubbish on the field after harvest destroys the seed of the pest lying on and near the surface of the ground. Rotation of crops and destruction of alternative hosts are suggested.

Disease resistance to onion smudge, J. C. WALKER (*Jour. Agr. Research [U. S.], 24 (1923), No. 12, pp. 1019–1040, pls. 4, figs. 4*).—In an earlier paper (E. S. R., 44, p. 844) the author described the morphology and life history of *Colletotrichum circinans*, the cause of onion smudge. Further studies are said to indicate that the resistance shown by yellow and red varieties of onions is due to protective substances within the onion tissues. One of these is said to be a volatile oil, while the other belongs to a group of compounds associated with the flavone and anthocyanin pigments of the scales.

In general, white varieties are susceptible to this disease, while the colored ones show a high degree of resistance. However, if the dry outer scales of the bulbs are removed the underlying fleshy scales are susceptible to invasion. The expressed juice of succulent onion scales is said to be highly toxic to the fungus, due largely to the volatile onion oil. This is considered an important factor in limiting the parasitic action of the fungus. In the red and yellow onion bulbs are pigments, water extracts of which were found to cause abnormal germination and to retard the growth of the fungus. A substance (or substances) present in the outer scales of resistant bulbs and closely associated or identical with the red and yellow pigments is believed to be the chief factor causing resistance to smudge. It is said that studies are to be directed toward the isolation and identification of the toxic materials.

Potato diseases [Argentina], C. D. GIROLA (*Bol. Min. Agr. [Argentina], 26 (1921), No. 3, pp. 260–264, pl. 1, figs. 2*).—Potato diseases here noted as causing heavy losses are rosette (*Corticium vagum solani*) and scab (*Oospora scabies, Actinomyces chromogenus*), and as occasionally important late blight (*Phy-*

tophthora infestans) and wilt (*Fusarium solani*). Propagation, characteristics, and preventive or remedial measures are briefly discussed as locally applicable.

Studies regarding potato canker control, [C.] WERTH (*Mitt. Biol. Reichsanst. Land u. Forstw. No. 21 (1921), pp. 121–125*).—A continuation, with similar general treatment, is indicated of the studies previously noted (E. S. R., 47, p. 47).

The bionomics of the conidia of Phytophthora infestans, P. A. MURPHY (*Roy. Dublin Soc. Sci. Proc., n. ser., 16 (1922), No. 30–34, pp. 442–466*).—The present paper deals with the part played by contaminated soil, indicated in previous articles (E. S. R., 46, p. 145; 48, p. 846).

It is stated that the conidia of *P. infestans* when mingled with soil and kept out of doors may remain viable and capable of infecting potato tubers for three or four weeks longer in loam than in a quick-drying medium like silver sand. In indoor experiments conidia survived longer (40 days) in comparatively dry to somewhat moist soil than in very wet soil (26 days). Temperatures not above 20° C. do not injure conidia as long as sufficient moisture is present. The conidia will survive for 26 days at 30° if the atmosphere is saturated. The most fatal conditions are those combining lack of moisture with high temperature.

Under the most favorable conditions indoors, conidia in soil infected the tubers as freely after 44 days as when fresh. Conidia when placed in soil survived without producing mycelium. Conidia in air saturated with water vapor lived only 9 days. Contaminated surface soil, after the continuous passage through it of large quantities of water, may remain pathogenic to potatoes for more than 4.5 days.

As having a possible bearing on the resistance of conidia in soil, their method of germination was reexamined in the light of prevous work, which is summarized.

The conditions under which the continued existence of conidia, zoospores, and germ tubes in water was directly observed for periods exceeding, in some cases, 30 days are believed to represent those under which existence is possible for comparatively long periods in the soil.

Inspection and certification of growing crops of potatoes immune to wart disease (*Jour. Min. Agr.* [*Gt. Brit.*], *28 (1921), No. 8, pp. 736–741; also in Fruit, Flower, and Veg. Trades' Jour.* [*London*], *40 (1921), No. 24, pp. 631, 632*).—These notes show the extent of the work done and results obtained during 1921 in pursuance of the policy which the ministry has developed for the control of potato wart disease.

Fall and winter care of potatoes, J. E. KOTILA (*Michigan Sta. Quart. Bul., 6 (1923), No. 1, pp. 8–11, figs. 4*).—Descriptions are given of chilling attributed to the exposure of potatoes to temperatures near freezing, breakdown due to a lack of oxygen in storage, and blackheart caused by improper ventilation and overheating in transit or in storage.

Brusone of rice, R. FARNETI (*Atti Ist. Bot. R. Univ. Pavia, 2. ser., 18 (1921), pp. 109–122, pls. 10*).—Related to contributions previously noted (E. S. R., 18, p. 946; 19, p. 956) are the notes herein posthumously presented, with relevant matter including comments, by L. Montemartini.

Fungus diseases of soy bean, PAPE (*Mitt. Biol. Reichsanst. Land u. Forstw. No. 21 (1921), pp. 36–42, figs. 6*).—*Glycine hispida* in Germany is subject to attack by sclerotium disease (*Sclerotinia libertiana*) and by Botrytis disease (*B. cinerea*). A short descriptive account is given of each.

Watery rot of tomato fruits, F. J. PRITCHARD and W. S. PORTE (*Jour. Agr. Research* [*U. S.*], *24 (1923), No. 11, pp. 895–906, pls. 4*).—A new rot of tomato

fruits is described due to a physiological form of *Oospora lactis*. This disease is said to resemble closely the rot caused by *Bacillus carotovorus*. The rot is characterized by dark-colored water-soaked areas which start in the stem scar and spread slowly toward the blossom end of the fruit without the production of any pronounced odor. The organism is said to usually enter the fruits through the stem scar but may enter through wounds, cracks, and punctures. Both ripe and green fruits are readily infected. Laboratory experiments indicate that washing fruits with an efficient fungicide would control the disease during shipment.

Note on the occurrence of the finger-and-toe disease of turnips in relation to the H-ion concentration of the soil, W. R. G. Atkins (*Roy. Dublin Soc. Sci. Proc., n. ser., 16 (1922), No. 30–34, pp. 427–434*).—The turnip crop in one of two adjacent fields of similar clay soil was found to be badly infested with finger-and-toe, the other being free from the disease. It was found that these fields contained, respectively, 0.17 and 0.4 per cent of calcium, calculated as oxid. The H-ion concentration of the samples was pH 6.6 and pH 6.7, or slightly over, respectively, as determined colorimetrically. A bibliography of more than 100 titles is appended.

Disease factor in commercial pomology, T. R. Hall (*Better Fruit, 17 (1922), No. 2, pp. 5, 6, 18*).—This article deals with those diseases which originate in the field, spread, and cause decay, and those which arise during transit as the result of transportation and marketing methods.

Silver-leaf, W. L. Bedford (*Fruit, Flower, and Veg. Trades' Jour. [London], 41 (1922), No. 13, pp. 345, 346*).—Silver-leaf, until comparatively recently thought to be restricted to plums, is becoming familiar in apples grown on a commercial scale in England, and the disease (due to lack of special knowledge) has proved to be especially dangerous in small private holdings. The very popular variety Victoria appears to be the most susceptible, though the important variety Newton Wonder and some others are seriously attacked.

Cutting out infected shoots while the leaves are on is recommended. The removal and burning of seriously infected trees during the growing season is also regarded as important.

[Silver-leaf], S. P. Wells (*Fruit, Flower, and Veg. Trades' Jour. [London], 41 (1922), No. 15, pp. 415, 416*).—Supplementing the statement of Bedford, above noted, the present author states that he formerly found during summer the silvering and during autumn the characteristic fructifications of *Stereum purpureum* on plum, apple, gooseberry, cherry, hawthorn, nettle, red currant, peach, laurel, and oak, the disease, however, appearing to be epidemic only on the soft-wooded plum. Subsequent observation during 10 years would suggest that *S. purpureum* is not likely to become a serious factor in apple growing, as apple orchards harboring the disease were not seriously affected in wide areas throughout which plum plantations were completely devastated.

The disease is said to be noncontagious in the silvery stage, and recommendation is made to wait until the plum crop is gathered before proceeding to extirpate the diseased wood, which should be thoroughly done with fire.

Spray in the fall to control apple anthracnose, A. Frank (*Western Washington Sta. Bimo. Bul., 11 (1923), No. 3, pp. 56, 57*).—The author recommends spraying with Burgundy mixture or with Bordeaux mixture 3–4–50 between the middle of August and the first of September if the control of rot of fruit is desired, and for the prevention of cankers, pruning out of all dead twigs and branches and spraying with Bordeaux mixture 6–6–50 as soon as the fruit is picked.

Bacterial gummosis of cherries (*Better Fruit, 17 (1923), No. 10, p. 14*). In Oregon, infection by the bacterial organism causing cherry gummosis be-

gins in the fall, but may occur any time during the winter. The disease is carried by insects which puncture both bark and buds. It spreads under the bark, causing extensive injury which frequently remains hidden until spring or summer.

Investigations by the Oregon Experiment Station are said to have shown a large percentage of sweet cherry seedlings to be resistant to the disease. Though careful inspection and thorough surgical treatment, including disinfection of wounds with Bordeaux paste, are measurably effective, it is thought that resistant varieties constitute the ultimate solution of the bacterial gummosis problem.

Disease control in black raspberries, C. W. BENNETT (*Michigan Sta. Quart. Bul., 6 (1923), No. 1, pp. 12–14, fig. 1*).—A discussion is given of proper cultural methods, sanitation, and selection of disease-free stocks as factors in disease control.

Morphology and host relations of Pucciniastrum americanum, B. O. DODGE (*Jour. Agr. Research [U. S.], 24 (1923), No. 11, pp. 885–894, pls. 5*).—The results are given of a morphological study of *P. americanum*, a rust occurring on cultivated raspberries which also attacks the wild species, *Rubus strigosus*. Some species of Rubus were found scarcely, if at all, attacked by the fungus, but in a study of a number of hybrids at Bell, Md., many were found severely affected. The complete life history of the fungus is said to be unknown, but the presence of the rust on raspberry canes is thought to suggest the possibility of its overwintering on this host.

Outbreak of citrus blast in south [California], J. E. COIT (*Calif. Citrogr., 7 (1922), No. 7, p. 242*).—It is reported that citrus blast (a bacterial disease) had been recently discovered on orange trees in the foothills near Pasadena, and in similar regions where winter rainfall had been about 30 in. and cool showers had been frequent for some weeks previous to the outbreak.

Relative susceptibility of citrus fruits and hybrids to Cladosporium citri, G. L. PELTIER and W. J. FREDERICH (*Jour. Agr. Research [U. S.], 24 (1923), No. 11, pp. 955–959*).—The results are given of the study of a large number of varieties of citrus plants to determine their susceptibility to attack by *C. citri*. As only a few of the plants studied were large enough to bear fruit, the degree of susceptibility to scab was based on the amount of the disease present on the leaves and angular wood. About 50 species and varieties were investigated, and the range of citrus plants susceptible to scab has been extended much beyond the few well-known commercial varieties that have heretofore been reported. The evidence seems to indicate that scab is limited to citrus fruits and their hybrids, with the exception of the trifoliate orange (*Poncirus trifoliata*). Species and varieties within a group are said to vary in their susceptibility to scab.

Withertip, tear stain, and control of brown rot, J. T. BARRETT and H. S. FAWCETT (*Calif. Citrogr., 7 (1922), No. 7, pp. 232, 233, 254, figs. 3*).—The season of 1922 (as discussed by Barrett), though the most favorable to withertip and tear stain (*Colletotrichum gloeosporioides*) than any other since 1916–17, did not show so severe a form as at that period. The question is discussed as to the primary or secondary character of this disease. Pruning away of dead material is preferred to spraying.

Fawcett, discussing experiments in laboratory (packing house) control of brown rot (*Pythiacystis citrophthora*), states that immersing heavily infected lemon fruits in water at 115° F. or above for one minute or more completely prevented the development of brown rot. Immersion for two or more minutes at not lower than 110° partly prevented development.

At 115° the treatment was effective after the spores had been on the fruit for about 12 hours; at 120° it was effective after development for about 30 hours.

The shellbark disease of lemon trees, J. E. Coit and V. F. Blanchard (*Calif. Citrogr., 7 (1922), No. 8, pp. 259, 292, figs. 3*).—For some years a cracking and scaling in spots of the bark of lemon trees at least 9 or 10 years old has been noted, appearing somewhat earlier in the Eureka than in the Lisbon variety. The name shellbark is proposed as fairly descriptive and suggestive. The disease is distinct from brown rot gummosis and Botrytis gumming.

If the scraping operation leaves the smallest spot this becomes a focus of the disease, which spreads beneath the surface.

Thorough scraping and painting with Bordeaux mixture until after the middle of August appears to be fully effective and harmless, costing only about 30 cts. per tree. Heavy pruning is an aid to recovery as regards production. Whitewash should be applied to prevent sunburn.

The soil should be removed and kept away to expose the base as far down as the bud union or down to the main crown roots. It is of little use to fertilize the soil in any special way. The most promising time to work against the disease is between the tenth and the fifteenth year.

Psorosis (scaly bark) of orange trees, H. S. Fawcett (*Calif. Citrogr., 7 (1922), No. 7, pp. 224, 241*).—An investigation into the causation, development, and control of orange tree scaly bark carried on for a number of years, though hampered partly by the extreme slowness of development of the disease in its incipient stages, has led to the conclusion that the visible advance of the disease depends much upon the season of the year. Experiments in treatment as outlined show that a method of scraping the outer bark, varying in depth according to circumstances, has been more effective than any other. Suggestions are detailed for treatment in each of the three stages. The kind of fungicide used appeared to be of minor importance in certain experiments.

Gloeosporium disease of walnut trees, Pape (*Mitt. Biol. Reichsanst. Land u. Forstw. No. 21 (1921), pp. 32, 33, fig. 1*).—Unripe nuts of *Juglans regia* were observed in the summer of 1920 to be attacked by a Gloeosporium, possibly a new species, which is partly described.

ECONOMIC ZOOLOGY—ENTOMOLOGY.

Savage Sudan: Its wild tribes, big game, and bird life, A. Chapman (*London: Gurney and Jackson, 1921, pp. XX+452, pls. 30, figs. 200*).—This is a work dealing in large part with big game and birds, and contains a chapter on the white ant (termites) (pp. 330–334).

Report of the entomologist [of the Florida Station], J. R. Watson (*Florida Sta. Rpt. 1922, pp. 56–59*).—A brief account is given of the status of the work of the year with insect pests.

Work with thrips on citrus has shown (1) that the spray application should be made during the height of the bloom, (2) that weeds are important as a source of infestation, (3) that the results will more than repay the cost of the nicotin sulphate in a combination spray when there are as many as 10 thrips to the bloom, and (4) that oranges are more seriously injured than are grapefruit. It was shown that a dust composed of lime impregnated with nicotin sulphate will kill all thrips hit, although it is necessary to hit a blossom squarely and with considerable force to get the dust into the interior of the blossom where the thrips work. The thrips do not seem to be as important pests of the Satsuma as of the round oranges, due largely to the fact that the Satsuma blooms about a month later than the round, after the maximum infes-

tation of thrips has passed. A bulletin on the flower thrips has been noted (E. S. R., 47, p. 655).

[Report of the Louisiana Station's] entomological department, T. E. HOLLOWAY (*Louisiana Stas. Rpt. 1922, pp. 8, 9*).—In a series of experiments conducted with a number of chemicals with a view to destroying the sugar cane borer in seed cane, only negative results were obtained. An investigation of the effect of soaking the cane in heated water showed that an exposure to a temperature of 122° F. for 20 minutes will kill all borers without injuring the germination, in fact, the germination is hastened by the treatment. The author reports that some cane treated in this manner which was planted in October germinated so satisfactorily that in December there was a stand equal to that usually secured in June. In a comparison of the germination of three varieties of cane with untreated cane planted at the same time, it was found that there was an increase in the treated of from 191 to 264 per cent. This offers great promise to sugar planters, not only in controlling the cane borer but in prolonging the growing season and securing a better stand of cane.

The inspection of fields on various plantations made in the fall for the parasite *Euzenilliopsis diatraeae* Town., which was introduced from Cuba in 1919 and 1920 by the U. S. D. A. Bureau of Entomology cooperating with sugar planters, resulted in the detection of its presence on 14 plantations. About 1,500 individuals of the parasite *Habrobracon brevicornis* Wesm., introduced from southern France to combat the European corn borer, were released in cane fields to determine its relation to the sugar cane borer.

Notes on the insect pests of Utah, I. M. HAWLEY (*Jour. Econ. Ent., 16 (1923), No. 4, pp. 377–379*).—A brief report upon observations of insect pests during 1921 and 1922.

Fifty-third annual report of the Entomological Society of Ontario, 1922 (*Ent. Soc. Ontario, Ann. Rpt., 53 (1922), pp. 92, figs. 14*).—This report includes the following papers: The Distribution of the European Corn Borer in Ontario During the Summer of 1922, by L. S. McLaine (pp. 10–13); Plowing as a Factor in the Control of the European Corn Borer in Ontario, by H. G. Crawford (pp. 13–18); Further Notes on the Life History of the European Corn Borer in Ontario, by G. J. Spencer (pp. 18–25); The Economic Importance of Insects as Food for the Common Whitefish, by W. A. Clemens (pp. 26, 27); Provancher, the Canadian Linnaeus—His Life and Works, by G. Maheux (pp. 28–30); Relation of the Biological and Taxonomic Studies in Syrphidae, by C. H. Curran (pp. 30–33); Insects of the Season in Ontario, by L. Caesar and W. A. Ross (pp. 33–39); Notes on *Frankliniella tritici* (Fitch), by R. C. Treherne (pp. 39–43); Some Notes on the Biology of Two Buprestids Infesting Blackberry and Hazel (*Agrilus ruficollis* and *A. politus*), by C. B. Hutchings (pp. 43–46); Insects of the Season in Quebec in 1922, by Maheux (p. 46); The Feather Mite [*Liponyssus bursa*]—A New Pest of Poultry, by Caesar (pp. 47, 48); The Grape Leafhopper, by Ross and W. Robinson (pp. 48–60); Mechanical Devices as Aids in the Control of the Strawberry Root Weevil (*Otiorhynchus ovatus* L.), by W. Downes (pp. 61–64); Recent Work on the Rose Chafer in Ontario, by Ross and J. A. Hall (pp. 64–70); Oviposition of *Hypera punctata*, by H. F. Hudson and A. A. Wood (pp. 70–72); The Sunflower Maggot (*Straussia longipennis* Wied.), by J. E. Brink (pp. 72–74); Notes on the Seed Potato Magot (*Hylemyia trichodactyla* Rond.), by G. H. Hammond (pp. 74, 75); and The Entomological Record, 1922, by N. Criddle and Curran (pp. 76–90).

Economic entomology in Mozambique and its problems, C. B. HARDENBERG (*So. African Jour. Sci., 19 (1922), pp. 285–291*).—The author here briefly summarizes the status of economic entomology in the Province of Mozambique.

East Africa, mentions the problems to be met, and advances suggestions as to the methods to be pursued in solving them.

List of publications on Indian entomology, 1920–21, compiled by [T. B. FLETCHER] (*Agr. Research Inst., Pusa, Bul. No. 139 (1922), pp. 67*).—This list, compiled by the imperial entomologist, is arranged by authors in alphabetical order.

The effect of CS_2 on the germination of seeds, C. J. WILLARD (*Jour. Econ. Ent., 16 (1923), No. 4, pp. 388–392*).—"It would seem that in practice no aeration of storage places is necessary after fumigation with CS_2 whatever dose may be used, unless they are air-tight. Bins and similar storage places for seeds almost never are air-tight, and before any of the longer periods reached by these experiments had elapsed the CS_2 would have diffused out of the bin. It required very large doses of bisulphid for a considerable period of time to have any marked effect on the germination of the seeds used in this experiment. The injury slowly becomes greater as the time increases and as the dose increases, but is not directly proportional to either. Seeds vary tremenduously in their resistance to CS_2 injury. Different varieties of the same species are very differently affected, perhaps due to the pigment in the seed coat. (Note garden beans and cowpeas.) The first injurious effect of CS_2 on seeds is a retardation of germination. It seems that liquid CS_2 poured on most seeds in fumigation will not injure them sufficiently to be of practical importance."

Fumigation practice up to date (*Calif. Cult., 61 (1923), No. 1, pp. 3, 10, fig. 1*).—This paper includes a brief statement by H. J. Quayle on calcium cyanid dust as an insecticide. Fumigation by blowing finely powdered calcium cyanid under tented trees infested with black, red, and citricola scales is said to have given highly satisfactory results, since all the scales were destroyed and no injury to the trees resulted. Moisture seems to be an important factor in connection with the possible use of powdered calcium cyanid as a tree fumigant, and further experimental work to determine its effect is now in progress. Powdered calcium cyanid has also been used as a soil fumigant, and results thus far indicate that this form of cyanid is well adapted for soil fumigation.

Fumigation of citrus trees for control of insect pests, R. S. WOGLUM (*U. S. Dept. Agr., Farmers' Bul. 1321 (1923), pp. II+59, figs. 33*).—This practical account of the fumigation of citrus trees supersedes Farmers' Bulletin 923, previously noted (E. S. R., 39, p. 161). A detailed account of fumigation work in California by the U. S. D. A. Bureau of Entomology has been previously noted (E. S. R., 25, p. 363).

Ber (Zizyphus jujuba) fruit and its fly pest, J. L. KHARE (*Agr. Research Inst., Pusa, Bul. 143 (1923), pp. 16, figs. 2*).—This is a report of studies of *Carpomyia vesuviana* Acos., a small trypetid which attacks the ripening jujube fruits. The large, round, and sweet varieties of jujube are heavily attacked, but the small and sour varieties are practically free from fruit fly injury. Thus far this fruit fly has not been found breeding in any fruits other than jujube. The only other insect that appears to be injurious to the fruit is the reddish caterpillar of the moth *Meridarchis scyrodes*.

Notes on termites attacking tea in Ceylon, J. C. HUTSON (*Ceylon Dept. Agr. Leaflet 24 (1923), pp. 7, pls. 2; also in Trop. Agr. [Ceylon], 60 (1923), No. 5, pp. 291–298, pls. 2*).—Two classes of termites attack the tea bush in Ceylon, namely, those which bore into the heartwood of living bushes and form a complete colony in each infested bush, and the smaller scavenging termites which feed only on dead and diseased bark and wood and have their nests outside the bush, usually underground.

Some experiments on poison baits for the European earwig, B. B. Fulton (*Jour. Econ. Ent., 16 (1923), No. 4, pp. 369–376, fig. 1*).—This is a report of experiments at the Oregon Experiment Station with *Forficula auricularia* L.

"As a stomach poison for the European earwig, sodium fluorid has an equal or greater amount of toxicity than arsenious oxid and acts more rapidly. Wheat bran sweetened with molasses is sufficiently attractive to the earwigs for all practical purposes. The addition of amyl acetate does not increase the attractiveness of the sweetened bran for earwigs. Oat hulls are slightly more attractive than wheat bran. The adhesive property of the former makes it especially desirable for a bait to be applied to objects for poisoning half grown or adult earwigs, but not so good for scattering over the ground for young earwigs. Glycerin does not lessen the attractiveness of a bait and increases the length of time during which the bait is effective."

The European earwig, A. Frank (*Western Washington Sta. Bimo. Bul., 11 (1923), No. 3, pp. 55, 56, fig. 1*).—This is a brief account of *Forficula auricularia* L., a report of control work with which at the Oregon Experiment Station is noted above.

The alfalfa thrips and its effect on alfalfa seed production, H. L. Seamans (*Canad. Ent., 55 (1923), No. 5, pp. 101–105, fig. 1*).—Examination of a long series of thrips collected from alfalfa in Alberta shows that *Frankliniella occidentalis* Perg. is the most abundant species. During the latter part of the summer *Haplothrips statices* Hal. is said to be present, but not in serious numbers. It is stated that while the Province of Alberta has the largest consolidated acreage of alfalfa in Canada and is rapidly increasing this acreage as new irrigation projects are opened, very little alfalfa seed is grown, and new plantings are dependent upon imported seed as a result of the thrips attack. The most severe losses are caused by the great decrease in blossom production due to the thrips feeding on unopened buds, while lesser losses are caused by the thrips feeding on the ovaries of the opened flowers or on the young seed pods. Two years of experiments in early cutting, or "clipping" as it is generally called, have given results which warrant this method being used in seed-producing areas.

The effect of leafhopper injury on the sugar content of grapes, D. L. Van Dine (*Jour. Econ. Ent., 16 (1923), No. 4, pp. 353–357*).—"The grape leafhopper (*Erythroneura comes* Say) is a major pest in the vineyards of the Pennsylvania grape belt along Lake Erie. During seasons of high leafhopper infestation, the grapes do not ripen properly. This condition seriously reduces the market value of the grapes for table use and for the manufacture of juice. The extension department of Pennsylvania State College is furnishing a spray service to the grape growers for the control of vineyard insects and diseases, under the direction of the author. The effect of a nicotin spray on the leafhopper, under the high leafhopper infestation found during the season 1922, was determined by a comparison of the sugar content of grapes (as indicated by the Brix spindle) that received the nicotin spray with grapes that were not sprayed. The conclusion is that in a season of severe leafhopper infestation a nicotin spray applied to vines during the period when the maximum number of nymphs of the first generation of leafhoppers are present will permit the production of grapes of table quality. The work also demonstrates that the sugar content of the grape juice under conditions of high leafhopper infestation is an index to the efficiency of the control measure."

The European apple sucker (Psyllia mali Sch.), W. H. Brittain (*Nova Scotia Dept. Agr. Bul. 10 (1923), pp. 58, pls. 6, fig. 1*).—This bulletin summarizes the investigations of *P. mali* conducted by the author, including its distribu-

tion, injury, life history and bionomics, and control measures, which have been previously noted (E. S. R., 49, pp. 153, 758). A colored plate illustrating its life stages and a bibliography of 12 titles are included.

The scale insects of the subfamilies Monophlebinae and Margarodinae treated by Maskell, H. and E. MORRISON (*U. S. Natl. Mus. Proc., 62 (1923), Art. 17, pp. 47, pls. 3, figs. 19*).—Three genera, Nodulicoccus, Auloicerya, and Platycoelostoma are erected, and three species are described as new.

The cultivation of lac in the plains of India (Tachardia lacca Kerr), C. S. MISRA (*Agr. Research Inst., Pusa, Bul. 142 (1923), pp. [4]+83, pls. 23, figs. 14*).—This extended account replaces Bulletin 28, previously noted (E. S. R., 28, p. 654).

Further studies with paradichlorobenzene for peach borer control, with special reference to its use on young peach trees, O. I. SNAPP and C. H. ALDEN (*U. S. Dept. Agr. Bul. 1169 (1923), pp. 19, pls. 3, fig. 1*).—This is a report of investigations commenced in the fall of 1921 and extending through the spring of 1922, which were conducted in the peach belt of Georgia on trees ranging from 1 to 6 years of age, with a view to determining (1) the dosages that can be used effectively and with safety on young peach trees, (2) the effect of not opening up the soil mounds 6 weeks after applying the chemical and the effects from allowing the crystals to remain around the trees all winter, and (3) the effectiveness of late fall, winter, and spring applications to peach trees.

It was found that large doses of paradichlorobenzene, ranging from 1.5 to 2.5 oz., to which the tree is exposed for 4, 8, or 12 days, are not so effective against the peach borer as 0.75- or 1-oz. doses with an exposure of from 4 to 6 weeks. "The cambium layer of all peach trees ranging in age from 1 to 5 years treated with paradichlorobenzene for experimental purposes was uninjured in the summer following the application in the fall. Brown lesions were observed in the outer bark layers on a few trees, however, at a point near which the ring of crystals had been placed. No injurious results from not tearing down the mounds within 6 weeks after making the application to peach trees in Georgia could be discerned. During a normal fall in Georgia 1-oz. doses of paradichlorobenzene will entirely spend themselves, leaving little if any odor 6 weeks after the application. In Georgia it is not necessary to uncover the base of the older trees 4 to 6 weeks after applying the chemical. It is advisable, however, to use this precaution against tree injury if the fall is abnormally cool, or if the material is applied late, or if it is used on young trees.

"If the treatment is given to trees 4 years of age or younger, use 0.75-oz. doses. For trees 5 years of age and older use the 1-oz. dose. Spring treatments of paradichlorobenzene in Georgia are not as effective against the peach borer as the early fall treatments. Spring applications gave a borer mortality of 72.4 per cent, compared with from 95 to 100 per cent mortality from using the material in middle October. Very poor results were obtained in Georgia by applying the crystals during late November or early December. The most satisfactory results are obtained in central Georgia by applying the chemical October 10.

"In the laboratory 91 to 135 days were required for the evaporation of 0.5-oz. doses of paradichlorobenzene imbedded from 4 to 6 in. below the soil surface. One-half oz. doses placed on the soil surface evaporated in 16 days. One would conclude from this laboratory experiment that the soil mounded on top of the crystals to prevent surface washing and to serve as a container for the gas should not be deep, as the deeper the crystals from the top of

the soil the slower the gas will generate. Of course the normal rate of evaporation of paradichlorobenzene around peach trees in an orchard is much faster than it would be in the laboratory—the latter being at a lower temperature. Laboratory tests show that the gas is liberated at about the same rate in both sandy loam and clay soils. Laboratory experiments show that the gas will kill peach borer larvae as far down as 1 ft. below the soil level, and under laboratory conditions the gas killed all larvae at that depth within 3 weeks. The lower the temperature and the higher the moisture content of the soil, the slower is the action of the gas on the borers."

Emergence records of the peach tree borer, Aegeria exitiosa (Say), in Pennsylvania, E. M. CRAIGHEAD (*Jour. Econ. Ent., 16 (1923), No. 4, pp. 376, 377, pl. 1, fig. 1*).—In studies conducted from May 15 to August 10, 1921, 700 cocoons were collected, of which about 500 contained larvae. "From the 500 pupae, 174 males and 184 females emerged, making a total of 358 adults. About 4 per cent of the pupae were parasitized. In May, 1922, wire cages were placed around 52 trees, and records were made every 2 or 3 days from June 1 to October 5 during the emergence season. From the 52 trees a total of 657 adults were recorded, the first adult emerging June 26, while the first record of emergence in 1921 was June 16. However, that year the season was from 2 to 3 weeks early."

Controlling the gipsy moth and the brown-tail moth, A. F. BURGESS (*U. S. Dept. Agr., Farmers' Bul. 1335 (1923), pp. II+28, figs. 15*).—This is a revision and supersedes Farmers' Bulletin 845, previously noted (E. S. R., 38, p. 58).

The fruit-tree leaf-roller in the Bitter Root Valley, W. S. REGAN (*Montana Sta. Bul. 154 (1923), pp. 56, figs. 8*).—This account is based upon a survey of the literature and investigations conducted by the author and R. O. Young at Darby, Mont., commencing April 1, 1922.

The results of the comparative efficiency tests reported, details of which are presented in tabular form, show miscible oils to vary greatly in effectiveness. Only two of five brands tested, Dormoil and Universal Brand Dormant Soluble Oil, appeared to be of sufficient value to warrant their use for leaf roller control.

"Sixteen gal. of these miscible oils to the 200-gal. tank (8 to 92) is the minimum strength with which satisfactory results can be obtained, and 18 to 20 gal. to the tank can be used to advantage in cases of severe infestation without material injury to the trees. Application early in the spring, weather permitting, is as effective as treatment just before the hatching date. One hundred per cent control is impossible at present even with utmost thoroughness of application. Thorough application of miscible oil, including the terminal twigs, will control blister mite as well as leaf roller, making unnecessary a separate spraying with lime sulphur for blister mite. Dormoil, the only miscible oil tested for this purpose, applied before the buds opened, also gave almost perfect control of oystershell scale in badly infested orchards. Heavy asphaltum base oils are thoroughly effective for leaf roller control. Rain and freezing temperatures appear to have less effect upon results than might be expected. The spray gun with high pressure (275 lbs. or more) and driving stream is more effective than mist spraying with pole and nozzles for application of miscible oils to destroy the leaf roller eggs. Carelessness in the application of an effective miscible oil is the biggest factor in poor results.

"Arsenate of lead, at the rate of 4 lbs. (powder) to 100 gal. of water, can be used effectively in cases of mild infestation or as a supplement to oil spraying. There is no advantage in stronger applications if a spreader is used. Arsenate of lead will not protect the crop from serious injury in cases of

severe infestation, but injury to the fruit can be reduced and defoliation prevented by timely applications. Applications of arsenate of lead as the buds are separating in the clusters and just after the petals fall will give the best results. Application as the buds are opening and the eggs are hatching is valueless. Corn sirup or molasses added to arsenate of lead spray does not increase the effectiveness enough to warrant the additional expense. The effectiveness of arsenate of lead is greatly increased by the use of a calcium caseinate spreader. Calcium caseinate spreader, at the rate of 0.5 to 1 lb. to 100 gal, of water, prevents the decomposition and formation of black sludge, which results when arsenate of lead and lime sulphur are combined. Calcium arsenate is far less effective than arsenate of lead in destroying the leaf roller caterpillars.

"Natural enemies of the leaf roller are doing good work but can not be depended upon at present in the Bitter Root Valley to materially reduce the infestation."

A list of 16 references to the literature is included.

Notes on the length of time Aedes calopus (Stegomyia) larvae should be exposed to a film of kerosene, M. E. CONNOR and W. M. MONROE (*Jour. Econ. Ent., 16 (1923), No. 4, pp. 380–385*).—"A 10-minute exposure to a film of kerosene is sufficient to cause the death of all but a very small percentage of *A. calopus* larvae, and for this reason washerwomen may after 10 minutes skim off the film of kerosene from their water containers and use any portion of the water underneath. It would also seem that the petroleum acts not only to exclude the larvae's supply of oxygen but also as a toxin and in this capacity is responsible for most of the larval death rate, as its toxic action is more rapid than its mechanical effect."

A house fly plague in the American Expeditionary Force, P. SIMMONS (*Jour. Econ. Ent., 16 (1923), No. 4, pp. 357–363*).—This is a report upon observations made by the author in 1918 of the lack of fly control in one of the permanent camps of the American Expeditionary Force in the southwest of France.

Hessian fly control in Iowa, C. J. DRAKE, F. A. FENTON, and F. D. BUTCHER (*Iowa Sta. Circ. 86 (1923), pp. 11, figs. 5*).—This summary of information includes a map of the observation stations in Iowa in 1922, an illustration of the seasonal cycle of the Hessian fly in the State, and a sketch showing the plan of the field observation station.

Surface treatments for the cabbage maggot, W. C. O'KANE, C. R. CLEVELAND, and C. H. HADLEY (*New Hampshire Sta. Tech. Bul. 24 (1923), pp. 42*).—This is a report of certain phases of experimental work with the cabbage maggot at the station, begun in 1914 and concluded in 1922. The details of the investigations, presented in large part in tabular form, have been summarized as follows:

"The abundance of this species varies from year to year and from locality to locality in New Hampshire. In recording results, counts were made of the maggots and pupae found on the roots of plants. Infestation sometimes varied within the same field. A maximum of 106 maggots was found on a living cabbage plant. The earliest cabbage is subject to the most severe attack. Two periods of abundance of adults occur in southern New Hampshire, the first coinciding with the early dates for setting out cabbage plants and the second occurring six to eight weeks later. Adults in captivity lived an average of 17 days for the female and 17.7 days for the male. Eggs were laid in captivity in cages in which food was supplied, but not in cages in which food was withheld. In the process of egg laying the female hunts for a cavity in the soil and may cover the eggs with earth after they are laid.

"Observations to determine the possible attraction of manured plats as compared with unmanured yielded negative data. Flies were notably attracted to banana as bait and were readily poisoned in cage experiments. In field studies flies were poisoned, but the results of counts of maggots and pupae were negative. A dry mixture of tobacco dust and calcium carbonate gave interesting preliminary results as a surface treatment to reduce attack. Further experiments were carried out for several years, using the tobacco dust lime treatment on cabbage, beginning in 1916 and extending through 1922. Such treatment, properly applied, affords suggestive results. The same treatment was applied to radishes and turnips in a series of experiments beginning in 1917 and extending through 1922. The protection afforded by the treatment of radishes and turnips is well marked. The presence of the treatment at the base of plants exerts a repellent effect on the adults. Infusions that wash down into the soil through rain seem to have no definite effect on the larvae. Larvae in contact with the surface of the treatment appeared to be killed by it. Eggs laid in contact with the treatment are definitely affected by it, the mortality of such eggs ranging as high as 100 per cent."

Spread of the Japanese beetle, Popillia japonica Newm., C. H. HADLEY and L. B. SMITH (*Jour. Econ. Ent., 16 (1923), No. 4, pp. 349–353*).—In a discussion of this subject, the authors show that the area of infestation by the Japanese beetle has increased from less than 1 square mile in 1916, when it was first discovered in Burlington County, N. J., to 773 square miles at the end of the 1922 season, comprising adjacent portions of Pennsylvania and New Jersey.

Color marking of the striped cucumber beetle (Diabrotica vittata Fab.) and preliminary experiments to determine its flight, J. E. DUDLEY, JR., and E. M. SEARLES (*Jour. Econ. Ent., 16 (1923), No. 4, pp. 363–368, fig. 1*).—This is a report of observations undertaken with a view to defining the limits of the powers of flight of *D. vittata* and its general habits as to flight.

"After experiments with various dyes and coloring substances covering a period of 3 years, the most successful material for marking has been found to be 6 parts, by volume, of denatured alcohol (denatured with methyl alcohol), 4 parts of commercial cut shellac, the mixture colored with a saturated solution of various anilin dyes in alcohol. This material may be sprayed on the beetles with an atomizer. It dries quickly, adheres well to the body of the insect, retains its color indefinitely, and does not appear to interfere in any way with the normal functions of the insect.

During the summer of 1922, 3 lots of beetles, totaling 25,786 individuals, were marked and released. Of these, 49 were recovered after an average interval of 4.5 days. They flew an average distance of 0.5 mile, 5 flying over a mile each. This project is to be continued during the season of 1923."

Observations on the life history of Taphrocerus gracilis (Say), R. N. CHAPMAN (*New York Cornell Sta. Mem. 67 (1923), pp. 3–13, pls. 4*).—This is a report of studies of the bulrush leaf miner, *T. gracilis*, a buprestid which mines in the leaves of *Scirpus fluviatilis*, and the life history of which has not previously been recorded. The author first presents technical descriptions of its several stages and follows with an account of its life history and bionomics.

"The larval life is only about 3 or 4 weeks in duration. The pupal stage lasts 10 days, and the adults spend the remainder of the season feeding on the foliage of the food plant, *S. fluviatilis*. The method of hibernation is not known, but it seems probable that the adult beetles migrate to the upland to pass the winter, since none have been found in their usual haunts between late fall and early spring. The beetles are restricted to one food plant, *S. fluviatilis*, and are found only on that plant except when they have accidentally alighted on other plants, which they leave immediately. During the

first instar the larva is structurally much like that of the wood-boring Buprestidae, but in the subsequent instars it resembles other leaf-mining larvae. It has a pair of appendages developed on the prothorax which assist it while feeding and a pair of ambulatory ampullae, or prolegs, developed on the abdomen, which enable it to crawl about within its mine in the leaf."

Summary of observation on Rhynchophorus schach Oliv., the red stripe weevil of coconuts, G. H. CORBETT and D. PONNIAH (*Malayan Agr. Jour., 11 (1923), No. 4, pp. 79–88, pl. 1*).—This is a report of studies of *R. schach*, or *R. ferrugineus schach* Oliv., commenced in 1920, the details of which are to be published in bulletin form.

The sweet-potato weevil in Louisiana and its control, C. E. SMITH (*Louisiana Stas. Bul. 188 (1923), pp. 3–24, figs. 5*).—This report is based upon work conducted by the U. S. D. A. Bureau of Entomology in cooperation with the stations, commenced in April, 1918, and continued through June, 1920. A general account is given of the sweet-potato weevil, including its foreign distribution in the United States and in Louisiana, technical descriptions of its stages, a brief account of its life history and habits, wild host plants, dissemination, factors governing the amount of damage, natural enemies, wild food plant extermination, and methods of control.

An outbreak of the apple flea weevil, S. W. FROST (*Jour. Econ. Ent., 16 (1923), No. 4, p. 394*).—The author records an outbreak of *Orchestes pallicornis* Say at Morgantown, W. Va.

The possibility of transmitting a Calendra infestation from wheat to macaroni through the processes of milling and manufacturing, R. N. CHAPMAN (*Jour. Econ. Ent., 16 (1923), No. 4, pp. 341–348, pl. 1*).—This is a report of investigations conducted at the Minnesota Experiment Station, where this question has been of great practical importance to the milling and macaroni industries. In the experiments described it was shown that (1) no stage of the weevil could survive the process of milling the durum wheat into semolina, from which the macaroni is manufactured, even the eggs being unable to survive this process, (2) that the adult weevils would not oviposit in the semolina, and (3) even if the weevils or their eggs were present in semolina they could not survive the process of manufacturing the macaroni. It was also found that the weevils are introduced into the factory and lay their eggs on the macaroni while it is drying.

Report of the Dominion apiarist for the year 1922, C. B. GOODERHAM (*Canada Expt. Farms, Bee Div. Rpt. 1922, pp. 16, figs. 2*).—Details of the work of the apiarist, including experimental work with swarm control, breeding experiments, etc., are reported.

A revision of the North American species of ichneumon flies belonging to the genus Meteorus Hal., C. F. W. MUESEBECK (*U. S. Natl. Mus. Proc., 63 (1923), Art. 2, pp. 44, figs. 2*).—Thirty-two species, including the European species *M. versicolor* Wesm., a parasite of the brown-tail moth and now well established in the New England States, are recognized by the author, of which 13 are described as new to science.

Parasitism of the European pine sawfly, Diprion (Lophyrus) simile Hartig, Hymenoptera, Tenthredinidae, in Pennsylvania, E. A. HARTLEY (*Jour. Econ. Ent., 16 (1923), No. 4, pp. 386–388*).—In studies by the author at Syracuse, N. Y., a lot of 94 cocoons of the first spring brood of *D. simile* collected early in June, 1922, gave a parasitism of 53 per cent, almost entirely *Monodontomerus dentipes* Boh. "Another lot of 123 cocoons collected July 17, 1922, gave one *D. simile* and a number of *M. dentipes* by August 5. No more sawflies or parasites emerged that season. The following January

5, 1923, the remaining cocoons were opened, and 86 per cent were found to contain parasites in some stage, averaging 9 parasites to a cocoon. Twelve cocoons contained live pupae, and 3 were full of dead adults of *M. dentipes*. The great majority, however, bore from 1 to 20 larvae, all very much alike. Two of the cocoons yielded the puparium of a fly, probably a Tachina."

FOODS—HUMAN NUTRITION.

Oxygen and perforations in canned fruits, E. F. KOHMAN (*Indus. and Engin. Chem., 15 (1923), No. 5, pp. 527, 528*).—To determine the relative effect of varying amounts of oxygen in the can, apples were canned in enameled cans under three sets of conditions such as to bring about a variation in the oxygen content of from 14 to 80 per cent. The cans, about 30 in each set, were kept in an incubator at approximately 35° C. and examined at varying intervals of time.

The extent of perforation of the cans was found to vary with the original oxygen content of the can. It is concluded that the relative slowness of the disappearance of oxygen in enameled cans as compared with plain cans indicates that the disappearance of the oxygen is due to its action on the tin plate rather than to a combination with the fruit. This is also offered as an explanation for the fact that enameled cans perforate more rapidly than plain cans.

A critique of the Pirquet feeding system, with special reference to its underlying principles, H. K. FABER (*Amer. Jour. Diseases Children, 25 (1923), No. 5, pp. 339–349, figs. 2*).—This critical discussion of the Pirquet feeding system (E. S. R., 48, p. 462) is summarized as follows:

"Practical and theoretical reasons both militate against the general adoption of the Pirquet system of feeding. The sitting height on which it is based can not be measured with sufficient accuracy, and even slight errors in this measurement lead to serious errors in calculating the nutritional status of the individual and his food requirements. The Pirquet index of nutrition has a misleading resemblance to a percentage of normal weight into which it can not readily be translated. The Pirquet theory that sitting height and intestinal area are in close correspondence is neither susceptible of proof nor consonant with probability. Its corollary, that sitting height and food requirements bear a relationship to each other, while based on false premises, is probably truth, but depends for its validity on the fact that sitting height and body surface show a certain degree of correlation. This correlation is not close enough to permit the accurate calculation of the body surface from sitting height. Finally, the introduction of Pirquet's food unit, the nem, to supplant the calorie is highly undesirable, largely for practical reasons, and presents no advantages that would appeal to the American public."

Vitamins in connection with infant feeding, E. A. BARTON (*Jour. State Med., 30 (1922), No. 11, pp. 470–479*).—A general discussion.

The bios requirement of bakers' yeast, J. J. WILLAMAN and A. G. OLSEN (*Jour. Biol. Chem., 55 (1923), No. 4, pp. 815–836, figs. 3*).—This contribution from the Minnesota Experiment Station consists of a discussion, with accompanying experimental data, of the question of the identity of the yeast vitamin bios with the water-soluble vitamin B of higher animals, and of the need of yeast for bios in its growth. Throughout the paper an attempt has been made to correlate the data reported with the previous literature on the subject. The experimental method employed was that of N. A. Clark,[1] with the excep

[1] Jour. Phys. Chem., 26 (1922), No. 1, pp. 42–60.

tion that in the standard medium ammonium chlorid was used instead of ammonium nitrate.

The first point considered was the identity or nonidentity of bios and vitamin B. Evidence is presented which is thought to furnish proof that vitamin B is readily removable from a given medium by 95 per cent alcohol, while bios is not. Attention is also called to the conclusions of Fränkel and Scharf (E. S. R., 47, p. 663) and Funk and Dubin (E. S. R., 46, p. 759) that bios is less readily adsorbed by fuller's earth than is water-soluble B, and of Williams (E. S. R., 41, p. 670), Fulmer et al. (E. S. R., 45, p. 565), and Whipple (E. S. R., 44, p. 562) that the yeast vitamin is stable to boiling dilute alkali, while vitamin B is not.

In considering the question of the necessity of bios for the growth of yeast, the authors state that "the proof of its existence must involve (a) evidence that its absence from a medium otherwise complete prevents the normal growth of yeast; (b) its preparation in a form such that its addition to a known medium will make the latter essentially as good as beer wort for yeast growth; and (c) evidence that it does not contribute directly to the mineral, energy, or nitrogen requirements of yeast." Literature which is thought definitely to meet the first condition is summarized briefly. The evidence for the second and third is admitted to be as yet circumstantial. It is thought that the energy phase and mineral phases can be ruled out, but that it is more plausible that bios may contribute a particular nitrogen group which the yeast is incapable of synthesizing at all or to a limited extent only. To test this theory 19 compounds of nitrogen have been used in yeast cultures with and without ammonium chlorid and small amounts of beer wort, and the results obtained have been compared with similar work of other investigators, making in all over 60 compounds of nitrogen tested. None of these compounds gave evidence of being bios itself.

Report of the associate food research committee for the year 1921–22 (*Canada Council Sci. and Indus. Research Rpt. Admin. Chairman, 1922, pp. 34, 35*).—In this progress report on an investigation of the vitamin B content of rice polishings, the results of a comparison of various yeast methods of determining vitamin B are summarized briefly.

The method suggested by Bachmann (E. S. R., 42, p. 59) of determining the amount of gas produced by the growth of yeast in the media containing the vitamin extract was found to be inaccurate on account of the varying rate at which the gas was absorbed by the culture media. The method of filtering off, drying, and weighing the yeast cells was discarded as tedious and time consuming. The method of Funk and Dubin (E. S. R., 44, p. 861) was considered to be the most suitable of the yeast methods, and certain modifications of this method are now being studied.

Concentrated extracts of vitamin B have been prepared by extracting rice polishings with from 0.1 to 1 per cent acetic acid solution, evaporating the extract to dryness, and fractioning the residue with alcohol of various strengths. The process is said to remove from 75 to 85 per cent of the inactive material, leaving a highly concentrated extract.

The utilization of carbohydrate by rats deprived of vitamin B, H. A. Mattill (*Jour. Biol. Chem., 55 (1923), No. 4, pp. 717–727, fig. 1*).—This paper consists of a concise review of the literature on the possible effect of a lack of vitamin B on metabolism processes, particularly that of carbohydrates, and the report of a further contribution to this question in the form of determinations of the respiratory quotient of normal rats and rats deprived of vitamin B in the fasting condition and following the ingestion of cane sugar and of glucose.

The respiration apparatus used consisted of a bell jar of from 5 to 6 liters capacity which rests on a vaselined glass plate. The stopper of the bell jar is provided with three holes, one for a mercury manometer, one a thermometer, and one a bent glass tube connected by a stopcock with the usual form of gas sampling tube containing mercury. A crystallizing dish slightly smaller in diameter than the bell jar is used to hold the rat being tested. With an apparatus of this size it is considered that in an interval of from 10 to 20 minutes a full grown rat produces sufficient changes in the CO_2 and O_2 of the confined air to be determined with sufficient accuracy when analyzed in the Haldane apparatus.

The animals used in the experiment were fed a synthetic ration consisting of casein 18, starch 50, lard 23, salts 4, and butterfat 5 per cent. The controls received the same diet with the substitution of 5 per cent of dry baker's yeast in place of an equal weight of starch.

With few exceptions the basal respiratory quotients of the normal controls varied from 0.73 to 0.78, with an average of 0.755 for 30 determinations. The minimum and maximum values for the vitamin B deficient animals were 0.7 and 0.78, with an average of 0.745 for 15 determinations. The nonfasting quotients varied from 0.79 to 0.97 in the controls, with an average of 0.84 for 23 determinations and from 0.71 to 0.87 in the animals on the deficient diet, with an average of 0.78 for 19 determinations. These results are thought to indicate no difference in the metabolism of the normal animals and those on the deficient diet other than the differences in the nonfastnig quotients due to the semifasting condition of the animals on the vitamin deficient diet.

The ingestion of cane sugar by the normal animals was followed after about 3 hours by a rise in the respiratory quotient to from 0.8 to 0.9. High values, frequently above 1, were obtained during the following 3 to 6 hours. Similar results were obtained with the test animals. No change could be observed for about 3 hours, after which the quotient rose to 1 or above. In one case the value did not exceed 0.85. With this exception, no evidence was obtained of any impairment in the digestion and utilization of cane sugar.

In the experiments with glucose the quotients rose more rapidly. Within an hour the normal animals gave figures of from 0.9 to 1. A slightly longer time was required for the animals on the diet deficient in vitamin B, but even after losing 40 per cent of their weight quotients as high as 1 and 0.96 were obtained in from 1½ to 3 hours.

It is concluded that vitamin B is not related specifically to the metabolism of carbohydrates.

A note on the effect of some organic acids upon the uric acid excretion of man, H. V. Gibson and E. A. Doisy (*Jour. Biol. Chem., 55 (1923). No. 4. pp. 605–610*).—In an effort to explain the increased excretion of uric acid after the ingestion of amino acids (E. S. R., 40, p. 175), a study was made of the effect upon uric acid excretion of the administration of the organic acids obtained by oxidative and by hydrolytic removal of the amino group from alanin, or pyruvic and lactic acids, respectively. The experiments were conducted on two normal men, using the same general scheme as the earlier experiment. After the collection of two or three normal hourly specimens of urine, approximately equimolecular quantities of the sodium salts of lactic and of pyruvic acid were ingested. For comparison alanin and glycollic acid were also given.

Pyruvic acid increased the hourly excretion of uric acid from 17 to 25 mg. in one experiment and from 16 to 28 mg. in another, amounts about equal to that produced by equivalent amounts of alanin. Both lactic and glycollic

acids, on the contrary, caused an immediate depression in the amount of uric acid to about one-half the quantity excreted before the ingestion of the acid.

In discussing these results, data are also presented on the content of uric acid in the blood and plasma following the ingestion of amino acids, of pyruvic acid and of lactic acid, and of the effect of lactic acid upon exogenous as well as endogeneous uric acid excretion. These data show that lactic acid causes a slight rise in the uric acid content of the plasma simultaneously with the decrease in the uric acid content of the urine. When lactic acid was ingested with cottage cheese or sweetbreads, both of which increase the uric acid excretion, there was a decreased output of uric acid, thus pointing to an increased threshold of the kidney for uric acid as the result of lactic acid ingestion.

The opposite effects of lactic and pyruvic or amino acids upon the uric acid excretion are also considered to furnish evidence against the hydrolytic deamination hypothesis. "There is a rapid rise (unpublished observations) in the excretion of nitrogen after the ingestion of amino acids which we consider to be due to deamination. The deaminized product is rapidly made available, and if much of it were lactic acid it is probable that a decreased output of uric acid would result. Actually an increase occurs, so it may be considered probable that hydrolytic deamination is not the chief pathway of decomposition. Oxidative deamination is not so excluded."

Sugar elimination after the subcutaneous injection of glucose in the dog, S. R. Benedict and E. Osterberg (*Jour. Biol. Chem., 55 (1923), No. 4, pp. 769–794*).—This paper is concerned chiefly with a critical discussion of some of the points raised by a previous paper by Folin and Berglung (E. S. R., 47, p. 263), with whose findings and conclusions the present authors do not agree.

Experimental tuberculosis in rats on varied diets.—Protein and salt factors, L. B. Lange and N. Simmonds (*Amer. Rev. Tuberculosis, 7 (1923), No. 1, pp. 49–59, figs. 9*).—In an attempt to test the reaction to infection with the tubercle bacillus in animals under controlled conditions of environment and diet, four series of rats were infected with bovine tubercle bacilli by subcutaneous inoculation into the groin. The progress of the infection was studied at intervals of one week for five weeks, by killing with ether a stated number of infected and one noninfected animals, autopsying them, and examining the lesions macroscopically and microscopically. Three series were on diets of adequate, high, and low protein content, but otherwise complete, and the fourth on a diet deficient only in salts.

In the first three series no significant difference was noted in the reaction to infection either in general condition and weight curves or in autopsy findings. The animals of the fourth series showed a more extensive local reaction at the site of inoculation. In all four series there was a high resistance to the tuberculous infection, marked by slow shrinkage and absorption of the tuberculous tissue, accompanied by disappearance of the tubercle bacilli.

The epidemiology of botulism, J. C. Geiger, E. C. Dickson, and K. F. Meyer (*U. S. Pub. Health Serv., Pub. Health Bul. 127 (1922), pp. IV+119, pl. 1, figs. 16*).—This is the complete report of the extensive investigation on the epidemiology of botulism conducted by the botulism commission appointed in 1919 under grants from the National Canners Association, the Canners League of California, and the California Olive Association. The scope of the investigation, as outlined in the introduction to this report, consisted in "first, a careful statistical analysis of the anatomical and bacteriological data which were already available or which could be collected from previous outbreaks of human and animal botulism, second, a clinical study of typical and atypical cases with special emphasis on the value of the specific serum treatment, and

third, an extensive experimental study dealing with the distribution and sources of *Bacillus botulinus*, including particularly an investigation of the factors predisposing to the production of toxin in certain types of food. The original plans to confine the study to botulism in the State of California were subsequently broadened, and this report includes a study of all the outbreaks in the United States concerning which records were available."

The subject matter of the report is dealt with in chapters dealing successively with human botulism in California, Washington, and elsewhere in the United States and Canada, botulism in domestic animals, features of botulism, and general discussion. Many of the investigations summarized in the report have been noted previously from other sources.

The food products which have been proved or considered to be responsible for the various reported cases of botulism are as follows: For home-canned products string beans 17, corn 9, asparagus 5, apricots 3, pears 2, spinach 2, beets 1, home brew liquor prepared from old home-canned products 1, cottage cheese 2, pickled mackerel and herring 1, ham 2, blood sausage 1, salt pork (?), and beef products 3, and for commercial products spinach 6, minced olive relish 3, pickled and bottled ripe olives 7, beets 2, string beans 3, corn 1, pork and beans 1, tomato catsup 1, sausages 2, cured ham 1, clam juice 2, tuna fish 1, evaporated milk 1, and minced chicken 1.

It is emphasized in conclusion that spoilage due to *B. botulinus* can not always be determined by the appearance or odor of the food.

An experimental study of the methods available for the enrichment, demonstration, and isolation of Bacillus botulinus in specimens of soil and its products, in suspected food, in clinical and in necropsy material, B. J. Dubovsky and K. F. Meyer (*Jour. Infect. Diseases, 31 (1922), No. 6, pp. 501–540*).—This and the 10 following papers report in detail certain phases of the botulism investigation not covered in the above report and dealing for the most part with the distribution of the spores of *B. botulinus* in this and other countries. This paper describes the methods developed by the authors for the enrichment and demonstration of *B. botulinus* in soils, suspected foods, and clinical and necropsy material.

"The composition of the medium, the preparation and heating of the samples, the period of incubation and storage, the identification of the toxin, and the isolation of the organism from toxic enrichment cultures are discussed and their value considered in the light of numerous experiments. It is emphasized that inexperienced workers should question their results until they eliminate the danger of laboratory contamination by continuous, painstaking vigilance, proper sterilization of the culture mediums, glassware, etc., and by repeated control examination."

The distribution of the spores of Bacillus botulinus in California, K. F. Meyer and B. J. Dubovsky (*Jour. Infect. Diseases, 31 (1922), No. 6, pp. 541–555, fig. 1*).—Using the methods outlined in the above paper, the authors have examined 624 specimens of soils, vegetables, fruits, feeds, manure, and sewage collected in 36 counties of California. Included in the tabulated report are data reported previously by Burke (E. S. R., 42, p. 260).

A total of 78 samples of virgin soil from areas definitely known to be free from contamination by animal excreta gave 45 toxic cultures, of which 43 were identified as *B. botulinus*, with type A predominating. Of 226 specimens of garden, orchard, and cultivated field soils, 59 gave toxic cultures, but in the majority of cases the toxicity was so weak that the cultures could not be identified by antitoxin tests. Type A was again the predominant type, although type B appeared more frequently than in the virgin soil samples. Three of the 17 cultures obtained from pasture soil contained type A and 1 type B.

Of the 122 specimens of garden vegetables and fruits examined, 33 produced toxic cultures of which 14 were weakly toxic and could not be typed, 12 were neutralized by type A antitoxin, and 7 by type B. The organism was readily demonstrated on the leaves and fruit of olives and in the scrapings of barrels used for shipping olives. Toxic cultures were produced from 17 of the 77 samples examined, the proportion of type A to type B being 1:4.

From 52 samples of hay, straw, and animal feeds, toxic cultures were produced in 10 cases, the relative proportion of A to B types being about the same as in soils on which the material was grown. No differences were noted between the feeds suspected of having caused forage poisoning and those not so involved. This is thought to contradict the assumption that the finding of *B. botulinus* in the feed proves that forage poisoning is a form of botulism.

Of 45 specimens of manure, only 3 were found to contain spores of *B. botulinus*, type A, and from a large number of samples of sewage no positive cultures were obtained. It is considered that these materials contribute but little to the contamination of the soil with this organism.

In all 74.8 per cent of the identified toxins were neutralized by type A, 22.1 per cent by type B, and 3.1 per cent by polyvalent antitoxin.

The distribution of spores of Bacillus botulinus in the soil of a restricted area in California, G. E. COLEMAN (*Jour. Infect. Diseases, 31 (1922), No. 6, pp. 556–558*).—The work described in this paper consists of a study of the distribution of spores of *B. botulinus* in a few soils taken from a narrow strip of coast line about 18 miles long in Santa Barbara County, Calif. Of 9 soil samples examined, all but 1 gave positive results for *B. botulinus*, type A. Negative results were obtained with a mixture of fresh horse manure from three stalls, and a weak toxin from chicken droppings uncontaminated with soil but obtained from a garden in which *B. botulinus* was found.

The distribution of the spores of Bacillus botulinus in the United States, K. F. MEYER and B. J. DUBOVSKY (*Jour. Infect. Diseases, 31 (1922), No. 6, pp. 559–594, figs. 4*).—In this extension of the study of the distribution of spores of *B. botulinus*, samples of soils, vegetables, and manures were obtained from every State in the Union except Virginia and examined as in the above studies. The experimental data are reported by States and in tables and distribution charts.

The outstanding feature of this study is the almost universal distribution of the organism, although it is much more prevalent in certain regions than in others. The relative distribution of the organism and of types A and B is summarized as follows:

"*B. botulinus* is a common soil anaerobe of the Western States of the Cordilleran system. It is less frequently encountered in the Atlantic States and is relatively rare in the Middle States, the Great Plains, and the Mississippi Valley. The soil of the Western States, inclusive of the Great Plains, yields mainly *B. botulinus*, type A, while the Mississippi Valley and Great Lakes region is characterized by a striking predominance of type B. Similarly prevalent is this latter type in the Atlantic States of Maryland, Delaware, New Jersey, Georgia, and South Carolina, while scattered findings of type A in Maine, New York, and Pennsylvania indicate the existence of breeding places in virgin forests and mountains. Soils which are subjected to intensive cultivation and fertilization contain, as a rule, *B. botulinus*, type B."

The data confirm the conclusions drawn in the second report that the spores are more prevalent in virgin and pasture soils than in worked-over soils. A comparison of the occurrence of the organism and the reported epidemics of botulism shows that both human and animal botulism is not infrequent in the States in which *B. botulinus*, type A, predominates. "From a practical stand-

point, however, *B. botulinus* is ubiquitous, and this survey gives no assurance that heat-resistant spores can not be found anywhere and at any time."

The distribution of the spores of Bacillus botulinus in the Territory of Alaska and the Dominion of Canada, B. J. DUBOVSKY and K. F. MEYER (*Jour. Infect. Diseases, 31 (1922), No. 6, pp. 595–599*).—The examination for spores of *B. botulinus* of 7 samples of soil from Alaska and 100 from various parts of Canada is reported. Of the Alaska soils only 1 gave a toxic culture and this could not be identified. Of the Canada soils, 27 gave toxic cultures of which 15 were identified by type A, 4 by type B, and 1 by polyvalent antitoxin. The greatest incidence was in the virgin soils of the western section.

The occurrence of the spores of Bacillus botulinus in the Hawaiian Islands and China, P. SCHOENHOLZ and K. F. MEYER (*Jour. Infect. Diseases, 31 (1922), No. 6, pp. 610–613*).—Of 39 soil and vegetable samples collected in the Hawaiian Islands, 11 produced toxic enrichment cultures and in 7 of these *B. botulinus* was identified. Five of the 7 positive cultures were type B, 1 type A, and 1 was neutralized by polyvalent antitoxin. Of 52 soil samples procured from two coast provinces in China, 13 gave evidence of containing *B. botulinus*, type B, and 1 type A.

The occurrence of the spores of Bacillus botulinus in Belgium, Denmark, England, The Netherlands, and Switzerland, K. F. MEYER and B. J. DUBOVSKY (*Jour. Infect. Diseases, 31 (1922), No. 6, pp. 600–609, fig. 1*).—Of 165 soil and vegetable samples obtained from various European countries, 20 were found to contain spores of *B. botulinus*, type B. No type A was found. The spores, while widely distributed, were not numerous nor very resistant to heat. The occurrence of human botulism in Europe is attributed to insanitary treatment of the raw materials rather than to the heat resistance of the spores. The scarcity of the spores and prevalence of type B is considered further evidence that extensive cultivation of the soil apparently eliminates type A.

Remarks on botulism as seen in Scotland in 1922, T. K. MONRO and W. W. N. KNOX (*Brit. Med. Jour., No. 3242 (1923), pp. 279–281*).—A description is given, with accompanying case reports of an outbreak of botulism at Loch Maree Hotel, Scotland, in August, 1922, involving eight cases, all of which were fatal. The outbreak was definitely traced to potted wild duck paste used in sandwiches. As the outbreak was the first known to have occurred in Great Britain and the scene was in a remote spot 20 miles from the nearest railroad station and 10 miles from the nearest physician, no opportunity was afforded for testing the value of botulinus antitoxin. It is stated that *Bacillus botulinus* and its toxin were isolated from one of the jars of wild duck paste, but the type is not reported.

Botulism at Loch Maree (*Analyst, 48 (1923), No. 564, pp. 118–120*).—This is a further discussion of the outbreak of botulism noted above, with special reference to canning problems.

Report of the circumstances attending the deaths of eight persons from botulism at Loch Maree (Ross-shire), G. R. LEIGHTON (*Edinburgh: Scot. Bd. Health, 1923, pp. 47*).—This is the official report on the outbreak of botulism noted above.

Some observations on the pathogenicity of Bacillus botulinus, G. E. COLEMAN and K. F. MEYER (*Jour. Infect. Diseases, 31 (1922), No. 6, pp. 622–649*).—In the introduction to this report the authors state "the study of this particular problem may properly be divided into three parts: (1) The injection or ingestion of detoxified *B. botulinus* spores or bacilli, (2) the injection or ingestion of the spores or bacilli together with a minute dose of *B. botulinus* toxin (or other substances) insufficient by themselves to produce symptoms of botu-

lism, and (3) the latency of injected or ingested spores of *B. botulinus* in the animal body where such spores, due to various causes, may later germinate, multiply, or be freed of their toxin and produce symptoms of the disease."

This paper deals principally with the first of these conditions. The literature on this phase of the subject is reviewed and discussed, the technique employed in the present study is described, and the experimental data are tabulated and discussed. These data are thought to prove conclusively that "massive doses of toxin-free spores of *B. botulinus* are pathogenic when introduced into the animal body. These spores and the vegetative forms arising from them are rapidly disseminated throughout the tissues of the body. Toxin-free spores of *B. botulinus* germinate, and the vegetative forms arising from this germination multiply and liberate toxin in the animal body."

The heat resistance of the spores of Bacillus botulinus and allied anaerobes, J. R. Esty and K. F. Meyer (*Jour. Infect. Diseases, 31 (1922), No. 6, pp. 650–663, figs. 5*).—The principal results reported and conclusions drawn in this investigation have been essentially noted from another source (E. S. R., 49, p. 162).

The occurrence of Bacillus tetani in soil and on vegetables, B. J. Dubovsky and K. F. Meyer (*Jour. Infect. Diseases, 31 (1922), No. 6, pp. 614–616*).—A brief summary is given of observations on the occurrence of *B. tetani* in the soils and on the vegetables examined in the above series of studies. The organism was frequently found in the soils of the Eastern States, but seldom in those of the Western States. It was also isolated from the surface of vegetables grown near Bern, Switzerland, and from soil near Peking, China.

A safe method for securing anaerobiosis with hydrogen, A. C. Richardson and C. C. Dozler (*Jour. Infect. Diseases, 31 (1922), No. 6, pp. 617–621, fig. 1*).—A modification of the McIntosh and Fildes anaerobe jar similar to the one described by Brown (E. S. R., 46, p. 180), but with a few alterations in construction, is described and illustrated. In the present form the wires conveying the heating coil are soldered to short pieces of pyrex tubing, which are then cemented into the rubber stopper. Other changes consist in the use of a shield of asbestos sheet which is placed over the upper surface of the coil to prevent the heat from cracking the top of the jar, and of asbestos washers which are used instead of mica to deflect the heat from the inner ends of the rubber stopper. It is considered that if the technique described is used there is no possible danger of an explosion with this apparatus.

The use of the Zuntz-Geppert apparatus for respiration experiments with small animals, F. W. Krzywanek (*Biochem. Ztschr., 135 (1923), No 4–6, pp. 506–517, fig. 1*).—A modification of the Zuntz-Geppert respiration apparatus for use with small animals is described and illustrated, and the results are reported of its application to the determination of the respiratory quotient and energy requirement of rats under varying conditions. The apparatus can be used for 15-minute periods or longer and, with careful technique, is said to have an error of less than 1 per cent.

ANIMAL PRODUCTION.

The American Society of Animal Production.—Record of the proceedings of annual meeting December, 1922 (*Amer. Soc. Anim. Prod. Proc. 1922, pp. 156, figs. 12*).—This is the report of the annual meeting of the American Society of Animal Production held at Chicago in December, 1922 (E. S. R., 48, p. 398). Besides the papers previously mentioned and those abstracted in this issue, the following papers were presented: Study of Rice and Rice By-products for Fattening Swine, by E. H. Hughes (E. S. R., 48, p. 571) (pp. 59–

63); Some Problems in Teaching Animal Husbandry, by E. A. Trowbridge (pp. 136–140); and Animal Husbandry Extension Round Table, by J. R. Wiley (pp. 141, 142).

Some genetic experiments with guinea pigs and rats, H. L. Ibsen (*Amer. Soc. Anim. Prod. Proc. 1922, pp. 99–101*).—The genetic experiments with guinea pigs and rats reported below have been carried on at the Kansas Experiment Station.

Sex ratios in guinea pigs.—In 7,989 guinea pigs there were found to be 106.92 males to 100 females. No significant differences in the sex ratio occurred in litters of different sizes or born in different seasons of the year, in stillborn animals or in those that died before 20 days of age, but the age of the dam seemed to have some effect, as females 15 months of age gave birth to 145 males to 87 females, while 192 males and 224 females were produced by females 8 months of age.

An environmental factor causing variation in weight at birth of guinea pigs.—The average weight of the fetus in guinea pigs has been found to be largely influenced by crowding. The effect of crowding is first on the weight of the placenta, which in turn affects the weight of the fetus. The correlation between the total distance on either side of the placenta and the weight of the placenta at the sixty-fifth day of gestation was 0.4623±0.0634 and for the sixty-sixth, sixty-seventh, and sixty-eighth days of gestation 0.6137±0.0743. The correlation between the weight of the placenta and the weight of the fetuses for the same periods of gestation were 0.7578±0.0246 and 0.7764±0.0404, respectively.

Effects of removal of the mammary glands of guinea pigs.—To test the theory that hormones secreted by the mammary glands play an important part in the onset of labor, the mammary glands were removed from several guinea pigs, 4 of which gave birth normally to 1 or more litters, no noticeable effect on the length of gestation being observed. Of 11 individuals born to such dams, 8 survived on the same food as the mother without milk or other animal feeds.

Inheritance of size in rats.—From matings of a 633 gm. male rat with a 235 gm. female over 60 offspring were produced, 1 male of which weighed 745 gm. The F_2s were more variable than the F_1s. Selection is now being carried on in the F_3 and F_4 generations for pure strains of certain sizes with the ultimate object of crossing the strains to study the mechanism of size inheritance.

Can sex in farm animals be controlled? M. A. Jull (*Amer. Soc. Anim. Prod. Proc. 1922, pp. 92–98*).—The approximate equality of sex in farm animals is noted, and the sex ratio observed in all the eggs laid by 45 pullets is reported.

The sex ratio, based on annual production, was 48.41±0.47 per cent males and for the eggs laid during March and April 48.82±0.8 per cent males. It was also observed that the first eggs the pullets lay are more likely to be males, the average of the first 20 eggs laid by each pullet being 62.91±1.44, which decreased with increased production to 32.53±1.15 per cent males for the one hundred and first to the one hundred and twentieth eggs. The cause of the variation is assumed to be the more frequent passage of the female producing complex into the polar body during the first laying, but after laying has continued for sometime the male producing complex is more often extruded in the polar body. Several possible explanations are offered, but none which would aid in any direct means of controlling sex.

Digestibility of cattle feed, J. A. Fries (*Amer. Soc. Anim. Prod. Proc. 1922, pp. 33–46*).—The author discusses two errors in the usual digestion experiments with ruminants, i. e., the presence of metabolic products in the feces con-

sisting mainly of protein and ether extract, making their digestibility in the feed appear too low, and fermentation with the production of gases, making the digestibility of the carbohydrates in the feed appear too high. The error is greater in the latter case. Using as an example a hypothetical ration of insoluble horn shavings and starch, the digestibility of the starch when ignoring the formation of gases was 100 per cent, but considering the methane formed it was 85.66 per cent, and when considering both the CH_4 and CO_2 as starch the digestibility of the starch was 62.1 per cent, whereas only 43 per cent of the energy of the starch was utilizable by the animals.

The digestible energy of timothy hay, red clover hay, alfalfa hay, oat straw, wheat straw, corn meal, wheat gluten, and starch calculated on a feed minus feces basis and compared with the digestible energy calculated by considering the gases formed showed that the digestible coefficients were much lower in the latter case, but there was a higher percentage utilization of the digestible energy and less variation between the different feeds in this respect.

The author suggests that the digestibility of feeds be calculated on the basis of "total feed eaten minus that portion of it (matter or energy) which can not contribute to the cell activity of the animal body no matter what form the useless matter assumes," and that "the digestibility be determined and expressed in terms of energy and not alone in terms of dry matter or nutrients." Where determinations of gases can not be made average figures may be used as follows: 4.5 parts of methane by weight formed per 100 parts digestible carbohydrates, 3.2 volumes CO_2 formed per 1 volume CH_4, 13.34 calories as the energy value of 1 gm. of methane, and 2 calories as the heat of fermentation for 1 gm. of CO_2.

Nutritive value of mixtures of proteins from corn and various concentrates, D. B. Jones, A. J. Finks, and C. O. Johns (*Jour. Agr. Research [U. S.], 24 (1923), No. 11, pp. 971–978, figs. 7*).—Experiments in an endeavor to overcome the protein deficiency of corn meal by supplying other proteins from tomato seed press cake, soy bean flour, or peanut flour have been carried on at the Bureau of Chemistry, U. S. D. A. The results of the test showed that normal growth was produced in white rats when the rations contained from 12 to 15 per cent protein supplied by a ration consisting of 60 per cent of corn meal and 20 per cent of tomato seed press cake, peanut meal, or soy bean meal, or of 40 per cent corn meal and 40 per cent coconut meal. The balance of the ration consisted of fat and salt in each case. Growth was retarded when smaller amounts of the protein supplements were included in the diet.

Rats receiving a ration containing 7.2 per cent protein made gains per gram of protein consumed in 11 weeks of 0.73, 0.94, 1.23, and 1.48 gm., respectively, when all the protein was from corn meal; 4.1 per cent from tomato seed press cake and 3.1 per cent from corn meal; 4.7 per cent from peanut meal, and 2.5 per cent from corn meal; and when 4.6 per cent was from soy bean meal and 2.6 per cent from corn meal.

Great families and individuals of the Hereford breed, R. E. Hunt (*Amer. Soc. Anim. Prod. Proc. 1922, pp. 128–131*).—Hereford sires are classified according to their offspring which have been winners at the International Live Stock Exposition and at the Kansas City Royal from 1900 to 1921. The basis of scoring was fourth place 1 point, third 2, second 3, first 4, junior or senior champion 5, and grand champion 6. This meant that a grand champion would give his sire a total of 15 points.

Effects of different systems and intensities of grazing upon the native vegetation at the Northern Great Plains Field Station, J. T. Sarvis (*U. S. Dept. Agr. Bul. 1170 (1923), pp. 46, pls. 9, figs. 11*).—The results of cooperative

experiments by the Office of Dry Land Agriculture and the North Dakota Experiment Station to study the effect of different systems of grazing on the gains made by steers and the depletion of the grasses at the Mandan experiment station are reported.

Lots of 10 grade 2-year-old steers averaging about 750 lbs. each were grazed each year from 1916 to 1921 on limited areas of 100, 70, 50, and 30 acres from May 15 or June 1 to October 15 or November 1. During the grazing seasons of 1918 to 1921 another area of 70 acres was pastured by the system of deferred and rotation pasturing previously described (E. S. R., 35, p. 167).

The results of the experiment have been measured by the gains made by the cattle each year and the effect of the varying intensities of grazing on the permanent condition of the range as determined by the amount and kind of vegetation present from year to year. The cattle were weighed monthly, and the average gains made during each month for the 6 years of continuous grazing and the 4 years of deferred and rotation grazing are given. As regards the permanent grazing, the gains made in the 100- and 70-acre areas were about equal month for month. In average daily gains per steer per season, those in the 100-acre lot gained 1.92 lbs. and those in the 70-acre lot 1.96 lbs. The steers receiving 50 and 30 acres of pasture made gains through May and June which compared favorably with those in the 100- and 70-acre pastures, but during July the cattle in the 30-acre pasture began to make smaller gains, which were still less in August, and losses in weight occurred in each of the 3 years that some were pastured in September. The average pasturing season lasted 111 days on the 30 acres. The cattle on the 50-acre pasture were able to make normal gains through August, but the September gains were reduced, and the average showed heavy losses in October. The average daily gains for the animals pastured on the 50- and 30-acre lots were 1.65 and 1.63 lbs., respectively. Ten head were placed on the rotation pasture in 1918 and 1919. This number was increased in 1920 to 15 head and in 1921 to 17 head. The average daily gain made by the cattle in the rotation pasture for the 4 years was 1.8 lbs. per head.

The varying rates of grazing had a marked influence on the condition and kind of plants which continued in the different pastures. The 100-acre pasture deteriorated slightly from undergrazing, as was indicated by the increased coarseness of the weeds and the accumulation of old vegetation. An average of only 51 per cent of the forage cover was removed annually from this pasture, whereas 74 per cent of the cover was removed from the 70-acre lot. This seemed to be about the optimum amount for the continuation of the pasture from year to year without injury. An average of 93 and 98 per cent, respectively, of the cover was removed from the 50- and 30-acre pastures, which does not allow for the maximum production of forage in succeeding years. An increase in the number of plants of *Artemisia frigida* (pasture sage) is indicative of overgrazing on these pastures. The system of deferred and rotation pasture seems to be able to carry the most steers and produce the largest gains per acre with a minimum injury to the vegetation.

Botanical studies were made in connection with the grazing experiments, by studying the plants in mapped areas in the pastures and in areas which were isolated from grazing, by listing and counting the plants in other areas, by clipping areas at intervals of 10, 20, 30, and 40 day periods, and annually, by photographs and by general notes. The more common species of plants present on these ranges are *Bouteloua gracilis* (blue grama grass), *Stipa comata* (western needle grass), *Carex filifolia* (nigger wool), and *C. heliophila* (western prairie sedge). Excessive grazing or frequent clipping seems to be endured best by the blue grama grass, whereas the amount of western needle

grass is much reduced. Pasture sage increases under heavy grazing, due to the fact that the cattle do not like it.

Other studies reported included a mowing experiment in which the yields of plats mowed annually and biennially were compared. Germination tests of the seeds of the native grasses, seeding experiments with cultivated forage crops in the native sod, and records of the soil moisture were also investigated.

Wintering Wyoming range calves, F. S. HULTZ (*Wyoming Sta. Bul. 134 (1923), pp. 3–16, fig. 1*).—Two experiments in comparing different feeds for wintering range calves are reported in continuation of the test with yearlings and 2-year-olds previously noted (E. S. R., 38, p. 666; 46, p. 676). The results of the first experiments with calves have been briefly noted from the station report (E. S. R., 49, p. 466.)

Four lots of 10 calves each were selected for the second experiment, which lasted 168 days. The average daily rations per steer in the different lots were lot 1 10 lbs. of native hay, lot 2 5 lbs. of native hay and 1.125 lbs. of cottonseed meal, and lot 3 20 lbs. of sunflower silage and 0.5 lb. of cottonseed meal, the latter being increased to 0.75 lb. at the end of 28 days; during the last 56 days the ration was again changed to 5 lbs. of native hay and 1.125 lbs. of cottonseed meal. Lot 4 received 5 lbs. of native hay and 12.5 lbs. of sunflower silage for the first 28 days, 7 lbs. of native hay and 12.5 lbs. of sunflower silage for the next 84 days, and 10 lbs. of native hay for the final 56 days. The steers in the different lots averaged from 441 to 449.5 lbs. in weight at the start.

Average daily gains of 0.35 and 0.77 lbs., respectively, were made in lots 1 and 2. The gains of lots 3 and 4 are reported according to the feeds used. During the first 28 days they were —0.54 and —0.21 lb., respectively. During the succeeding 84 days they were 0.4 and 0.32 lb., respectively, and during the last 56 days 1.39 and 1.2 lbs. The calculated feed costs per 100 lbs. of gain were for lots 1 and 2 $14.38 and $6.74, for the 84-day period of lots 3 and 4 $22.59 and $26.97, and for the 56-day period of lots 3 and 4 $15.71 and $4.17, respectively.

The author concludes from the two experiments that native hay alone may be used for wintering steers, but substituting cottonseed meal for some of the hay increased the rate and economy of gain. Alfalfa alone, however, produced satisfactory gains in the first feeding trial. Sunflower silage was not an efficient supplement to native hay or cottonseed meal, and in the first trial oat and pea silage was no more efficient as a supplement to native hay than sunflower silage.

The effect of winter rations on subsequent pasture gains of 2-year-old steers, E. W. SHEETS (*Amer. Soc. Anim. Prod. Proc. 1922, pp. 64–67, fig. 1*).—This is a report of experiments with different feeds for wintering 2-year-old steers carried on at the same place and in a similar manner to the experiments noted with yearlings and calves (E. S. R., 44, p. 176; 46, p. 675).

The comparative rations fed were as follows: 18 lbs. of hay and 2 lbs. of corn; 29 lbs. of silage; 39 lbs. of silage; 29 lbs. of silage and 1.5 lbs. of cottonseed meal; 25 lbs. of silage 6 lbs. of straw, and 1 lb. of cottonseed meal; and 25 lbs. of silage and 7 lbs. of hay. The respective winter and summer gains made by steers on each ration were 17 and 312 lbs., —10 and 347, 66 and 283, 50 and 312, 85 and 259, and 59 and 277 lbs.

The author concludes that the method of winter feeding should be largely determined by the season of marketing and the cost of the ration. The differences in total yearly gains were not great, but the amount of gains put on during the summer and winter were very different.

The effect of winter rations on summer pasture gains of cattle, C. W. McCampbell (*Amer. Soc. Anim. Prod. Proc. 1922, pp. 77, 78*).—The summer gains made by 20 steers wintered on alfalfa hay as calves, yearlings, and 2-year-olds were compared with the gains of similar steers wintered on silage and approximately 1 lb. of cottonseed meal per day. The two lots were pastured together on bluestem grass each summer. On September 5 of the last summer one-half of the steers in each lot were given grain, whereas the rest of the steers were carried to September 30 on grass. The gains made by the alfalfa hay lot during the first, second, and third winters were, respectively, 61.2 lbs., 75.93, and 38.73 lbs. and by the silage lot 87.86, 155, and 12.14 lbs. The summer gains made by the steers wintered on alfalfa hay were, respectively, 295.2, 241.54, and 239.93 lbs. and by the steers wintered on silage 281, 139.93, and 253.26 lbs. The results show that the gains made on pasture depend on the fat the steers carry, and that those wintered on silage, if not too fat, will make rapid and satisfactory gains the following summer.

The utilization of feed by range steers of different ages, III, IV, J. D. Hungerford and L. Foster (*New Mexico Sta. Bul. 128 (1921), pp. 92, figs. 15*).—The utilization of two rations by range steers has been investigated under the same general plan as the studies previously noted in this series (E. S. R., 36, p. 470).

III. *Alfalfa hay and cottonseed meal* (pp. 1–33).—This experiment was carried on with 2- and 3-year-old steers in 1916 and calves and yearlings in 1917. Digestion trials are reported for 10-day periods with 2 steers from each lot made in each case during the first and third months of the 120-day test. Analyses of the feeds used are given for each trial. In discussing the results, the authors point out that one 3-year-old steer and two 2-year-olds seemed to be abnormal, and, therefore, in the data given below their results are eliminated from the averages.

The average daily gains per head made by the 3-year-olds, 2-year-olds, yearlings, and calves were, respectively, 0.89, 1.04, 1.63, and 1.32 lbs. and per 1,000 lbs. live weight 0.81, 1.05, 2.32, and 2.46 lbs. The gains made by each steer are given, and they are also presented in the form of curves. The steers in the respective lots consumed 21.24 lbs., 16.52, 10.44, and 9.27 lbs. of hay per pound of gain, and the ratios of the cottonseed meal to the amount of hay consumed were, respectively, 1:5.3, 1:5.1, 1:5.4, and 1:6.2.

Individuality was found to be a big factor in the ability of individual steers to digest the feed. No apparent advantage was shown by the 2-year-olds over the 3-year-olds, but the ration was consistently better digested by the calves than by the yearlings except for the protein and ash in the case of one of the yearlings in the second digestion trial. The advantage in favor of the calves was greatest in the case of the ether extract and crude fiber. The amount of dry matter consumed did not have any constant observable effect on digestibility. Calculations of the digestibility of the alfalfa hay were made by difference, using the averages of Henry and Morrison for cottonseed meal. The net energy consumed and the estimated energy of gains were calculated from the data on the basis of Armsby and Fries' tables for metabolizable energy of feeds.

After slaughtering at the end of the test, the average dressing percentages were 59.59, 58.63, 55.16, and 54.14 per cent for the 3-year-olds, 2-year-olds, yearlings, and calves, respectively. The internal fat present in the different lots indicated that the ration tended to produce growth but not finish in the younger steers. The carcasses of the older steers yielded a higher percentage of loin in relation to the other cuts and a greater percentage of fat in the different cuts. The younger animals carried the greatest percentages of lean

The relative amount of bone varied within the different ages. A chemical analysis of the meat from the different cuts was also made.

IV. *Alfalfa hay, milo meal, and cottonseed meal* (pp. 34–52).—Calves and yearlings were fed alfalfa hay and a grain mixture consisting of 1 part of cottonseed meal to 5 parts of milo. During the test the yearlings made average daily gains of 1.71 and the 2-year-olds 1.5 lbs. Per 1,000 lbs. of live weight the average daily gains were, respectively, 2.28 and 2.54 lbs. The yearlings consumed an average of 6.09 lbs. of hay and 3.69 lbs. of grain per pound of gain, whereas the calves consumed an average of 5.68 lbs. of hay and 3.07 lbs. of grain.

In the digestion trials the calves again digested the ration better than the yearlings. No relationship between the amount of feed and the digestibility was observed as in the previous test, but when a greater proportion of grain was fed in the second digestion trial the coefficients were higher for all nutrients except crude fiber. The digestibility of the grain mixture was calculated by difference on the basis of the digestibility of alfalfa hay as determined in the preceding experiment. The net energy values of the feeds and gains were also determined, from which it was concluded that the energy content of the gain made by the yearlings was higher than that of the calves.

The dressing percentages of the yearlings and calves after slaughter were, respectively, 58.68 and 55.66 per cent. The yearling carcasses contained more fat as determined by physical and chemical analyses. The results of the entire seven years' work are summarized in this bulletin, and the data collected on the 1916, 1917, and 1918 experiments are given in detail in the appendix.

A comparison of some silages for feeding cattle, F. W. Christensen (*Amer. Soc. Anim. Prod. Proc. 1922, pp. 75, 76*).—Four groups of five 2-year-old range steers each were fed at the North Dakota Experiment Station on different kinds of silages for 100 days, with the following results:

Summary of silage feeding test with steers.

Kind of silage.	Average initial weight.	Average daily gain.	Feed consumed per pound of gain.				Relative values of dry matter in silages.[1]
			Silage.	Oat straw.	Cottonseed meal.	Corn meal.	
	Lbs.	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Per ct.*
Sweet clover-oat straw[2]	950.0	1.10	9.3	2.2	1.7	1.5	84
Millet	957.9	1.26	11.9	2.1	1.5	1.4	69
Sunflower	941.1	1.05	10.1	2.9	1.8	1.7	82
Corn	981.6	1.72	8.0	1.2	1.1	1.1	100

[1] Based on first 60 days' results. [2] 7 parts sweet clover to 1 part oat straw.

The sunflower and sweet clover-oat straw silages had a dark color and strong odor and were less palatable than the corn and millet silages at first, but later they were as well eaten as the others. The steers on the corn silage were the best finished at the end of the test.

Preliminary reports of experiments with feeding steers, using cottonseed meal and molasses, E. Barnett and C. J. Goodell (*Mississippi Sta. Circ. 48 (1923), pp. 12, fig. 1*).—The results of two tests in which cottonseed meal and molasses were fed to steers in combinations with other feeds are reported.

The first test was carried on in 1920 with 5 lots of 10 steers each. The results of part of this trial have been previously noted (E. S. R., 49, p. 267). The rations consisted of silage ad libitum and an addition in lot 1 of an

average of 5.57 lbs. of cottonseed meal, lot 2 4.68 lbs. of cottonseed meal and 4.09 lbs. of corn, lot 3 4.03 lbs. of cottonseed meal and 8.39 lbs. of corn, lot 4 3.19 lbs. of cottonseed meal and 12.46 lbs. of corn, and lot 5 4.84 lbs. of cottonseed meal and 6.57 lbs. of blackstrap molasses per day. The concentrates were started in small amounts at the beginning of the test, but gradually increased as the trial progressed. The steers, averaging about 800 lbs. in weight at the start of the test, made average daily gains of 1.68, 2.01, 2.44, 2.54, and 2.4 lbs. in the respective lots.

Since lot 2 received practically the same feeds as lot 5 except for the substitution of 6.57 lbs. of molasses for 4.09 lbs. of corn, it is used for comparison. The results show that lot 5 made larger daily gains and showed better finish, but the dressing percentage was lower than in lot 2. The estimated loss per steer, however, was lower in lot 5 than in any of the other lots.

A 121-day feeding test, using 3 lots of 10 yearling steers each, was carried on in 1922–23. Each lot received corn silage ad libitum and a small amount of Johnson grass hay, and in addition lot 1 consumed daily an average of 5.48 lbs. of cottonseed meal, lot 2 5.48 lbs. of cottonseed meal and 2.59 lbs. of molasses, and lot 3 5.48 lbs. of cottonseed meal and 5.21 lbs. of molasses. The cottonseed meal and molasses were gradually increased from the start of the test as the steers were able to handle more of them. In addition to the consumption of cottonseed meal and molasses already mentioned, the steers in lot 1 consumed an average of 42.8 lbs. of silage and 3.88 lbs. of hay, in lot 2 41.17 lbs. of silage and 3.91 lbs. of hay, and in lot 3 40.51 lbs. of silage and 3.78 lbs. of hay. Average daily gains of 2.28, 2.38, and 2.51 lbs. per steer were made in the respective lots. The steers in lot 3 were finished a little better than those in the other two lots, but the costs per 100 lbs. of gain were also higher. The dressing percentages, based on home weights, were, respectively, 52.4, 53.47, and 53.6 per cent. The laxative character of the molasses ration was noted in lot 3 and was much more pronounced on their arrival at the market.

Beet by-products for steers and lambs, E. J. Maynard (*Amer. Soc. Anim. Prod. Proc. 1922, pp. 73, 74*).—Tests of the feeding value of beet tops, wet beet pulp, beet molasses, and dried molasses beet pulp for steers and lambs from the Colorado Experiment Station are briefly reported. The beet tops may be ensiled or pastured by putting them in piles 3 ft. in diameter and 2 ft. high. Stormy weather, however, may cause total loss in the latter case. Beet molasses furnishes a cheap source of carbohydrates. The molasses is sprinkled on other feed for steers in amounts of from 3 to 8 or 9 lbs. per day. Wet beet pulp, where available, is used in feeding cattle, sheep, and lambs. When fed with alfalfa and corn it has reduced the necessary time of fattening. Dried molasses beet pulp fed in equal parts with corn to lambs produced more returns than corn alone, but when fed alone with alfalfa it required 6.5 per cent more dried beet pulp and 4.5 per cent more alfalfa to produce the same gains as with the corn and alfalfa ration.

Cane and beet molasses for fattening lambs, J. M. Evvard, C. C. Culbertson, and Q. W. Wallace (*Iowa Sta. Bul. 215 (1923), pp. 369–400, figs. 3*).—After reviewing the literature dealing with the feeding value of cane and beet molasses, the results of an experiment in fattening 7 lots of 30 lambs each for 80 days on rations containing different amounts of molasses are reported. All lots received the same amounts of a basal ration consisting of shelled corn, linseed oil meal, corn silage, mixed hay (90 per cent red clover), and block salt. In addition to this basal ration, the following amounts and kinds of molasses were fed per head daily: Lot 2 0.25 lb. cane molasses, lot 3 0.5 lb. cane molasses, lot 4 full feed of the cane molasses. Lots 5, 6, and 7

received the same respective amounts of beet molasses. The following table gives a summary of the results of the test:

Summary of lamb feeding tests with molasses supplements.

Lot.	Average initial weight.	Average daily gain.	Feed required per 100 lbs. of gain.							Selling price per 100 lbs.	Average water consumed per day.[1]	Dressing percentage.
			Shelled corn.	Linseed oil meal.	Cane molasses.	Beet molasses.	Corn silage.	Hay.	Block salt.			
	Lbs.	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*		*Lbs.*	*P. ct.*
1.....	60.03	0.290	407.84	51.76	.....	.....	518.82	62.05	1.61	$10.15	3.08	48.78
2.....	60.14	.313	358.15	47.99	79.98	.....	491.66	57.32	1.51	9.80	3.49	49.50
3.....	60.56	.366	286.60	40.93	137.61	.....	420.13	48.80	1.76	10.00	3.77	50.13
4.....	60.32	.355	290.87	42.22	200.80	.....	431.44	50.19	.80	9.90	3.85	49.56
5.....	60.14	.323	345.07	46.38	.....	77.30	475.19	55.27	.86	9.85	3.50	49.22
6.....	59.98	.391	268.06	38.38	.....	129.00	391.62	45.95	.53	10.15	4.04	50.77
7.....	59.54	.384	271.43	39.07	.....	186.51	400.19	46.45	.21	10.30	4.24	50.24

[1] Includes water in feed.

The lambs receiving the addition of molasses to the ration made better gains, but they were less economical in all but lot 6 than in the lot receiving no molasses. The beet molasses seemed to produce slightly better and more economical gains than the cane molasses in the comparative lots. The optimum amount seemed to be 0.5 lb. per day of either kind. In regard to the condition of the animals, the authors state that there was practically no difference except for a slight laxative condition of all molasses lots. At slaughtering time, however, renal calculi were more numerous in the molasses-fed lambs, the following percentages being found: Lot 1 3 per cent, lot 2 3, lot 3 7, lot 4 23, lot 5 27, lot 6 30, and lot 7 48 per cent. In shipping to Chicago the molasses-fed lots all shrank more than the check lot, and there was much molasses smeared on the wool. Calculations of the relative value of molasses and corn are also given, based on the results of the experiment.

The influence of age and individuality upon the yield of wool, J. L. Lush (*Amer. Soc. Anim. Prod. Proc. 1922, pp. 105–109*).—The results of a statistical study of the individual weights of fleeces of 8 Corriedale ewes, 15 Rambouillet ewes, and 600 grade Rambouillet sheep sheared at a substation of the Texas Experiment Station during five years are reported. The sheep were divided into groups of the same age and sex, which were further divided into those sheared once or twice a year, and correlation coefficients were calculated for the weights of the fleeces of individual sheep during successive years. In all 104 correlation tables were worked out with coefficients ranging from +0.0443 to +0.9847, averaging +0.6149. Of these coefficients 95 were statistically significant.

From the study the author concludes that individual sheep remain fairly uniform from year to year in their production of wool. Thus, by culling on the basis of fleece weights one could obtain as much accuracy as in culling dairy cattle on the basis of a year's production.

Minerals for developing breeding gilts on pastures, J. M. Evvard, C. C. Culbertson, and W. E. Hammond (*Amer. Soc. Anim. Prod. Proc. 1922, pp. 17–22*).—In studying the mineral requirements of gilts on pasture at the Iowa Experiment Station, 12 lots of 5 gilts each weighing about 53 lbs. were selected for a 168-day test. In addition to a common pasture crop the odd numbered lots received a 3 per cent ration of shelled corn and 0.3 lb. of meat meal tank-

age (60 per cent protein and 15 per cent minerals) and whole oats self-fed. The even numbered lots received the same ration with the addition of ⅓ oz. of the fairly complete mineral mixture, which was also given in a self-feeder. The following table gives a summary of the results:

Growth and feed consumption of gilts on pastures with and without minerals.

Lot.	Pasture.	Average daily gain.	Feed required per 100 lbs. gain.				Total growth per gilt.		
			Shelled corn.	Whole oats.	Tankage.	Minerals.	Body length.	Shoulder height.	Circumference of fore shin.
		Lbs.	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*In.*	*In.*	*In.*
1	Blue grass	0.86	174	329	35	.....	15.9	9.4	1.94
2	....do	.90	167	316	33	3.5	17.5	9.5	1.98
3	Alfalfa	.96	157	285	31	.....	18.1	9.8	1.96
4	....do	.92	163	281	33	3.1	16.7	9.7	2.00
5	Red clover	.94	159	290	32	.....	16.7	9.3	2.02
6	....do	.96	157	280	31	2.3	16.2	10.5	2.00
7	Alsike clover	.96	156	277	31	.....	17.6	9.9	2.14
8	....do	.98	154	278	31	2.5	16.9	9.7	2.11
9	Annual sweet clover	.88	170	288	34	.....	17.1	8.8	1.93
10	....do	.89	168	282	34	3.1	15.3	9.7	1.96
11	Rape	.96	155	249	31	.....	18.2	8.9	2.06
12	....do	.86	175	289	35	2.9	14.2	8.9	1.70

The authors conclude that gilts receiving about ⅓ lb. meat meal daily in addition to corn, oats, and pasture are not likely to need additional minerals.

The effect of prolonged maintenance on subsequent growth and development in pigs, 1921–22, W. E. CARROLL (*Amer. Soc. Anim. Prod. Proc. 1922, pp. 12–16, fig. 1*).—Thirty pigs from 5 to 7 weeks of age were divided into three lots at the Utah Experiment Station and fed on rations of tankage, wheat shorts or ground wheat, ground corn, salt, and water. During the test lot 1 received the feeds in separate self-feeders, whereas lots 2 and 3 received only enough feed to maintain weight, fed as far as possible in the same proportions as consumed by lot 1. At the end of 12 weeks lot 1 was not making proper gains, so alfalfa hay leaves were also included in all the rations from that time on. Before alfalfa hay was fed the pigs in lot 1 made average daily gains of 0.4 lb. per head, but the gains increased to an average of 1.45 lbs. daily with the addition of alfalfa, the animals reaching 199.1 lbs. in 183 days.

Lot 2 was kept on the maintenance ration for 112 days and lot 3 for 210 days, the pigs making average gains of only 10.1 and 32.4 lbs. during these periods. At the end of the maintenance periods, the 8 surviving pigs in lot 2 and 5 pigs in lot 3 were placed on self-feeders until they reached approximately 200 lbs., lot 2 requiring 109 and lot 3 78 days. The respective average daily gains were 1.54 and 1.94 lbs. The results indicate that the pigs had not lost their power to grow even after the long maintenance period, and in fact those held for the longest period made more rapid and more economical growth on full feed than the other pigs.

[Swine feeding at the Huntley, Mont., Reclamation Project Experiment Farm], R. E. HUTTON (*U. S. Dept. Agr., Dept. Circ. 275 (1923), pp. 15–21*).—A number of feeding experiments were carried on in 1921, many of which are continuations of those previously noted (E. S. R., 46, p. 767). The results of the entire period over which the tests have been running are summarized.

The grazing period on the ¼-acre alfalfa plats pastured at the rate of 2,000 to 2,500 lbs. per acre was reduced to 125 days in 1921, due to a poor

growth of alfalfa. The average daily gains per pig were 0.72 and 0.71 lb. in the two lots. This includes the composite results of fall pigs pastured from May until July and spring pigs pastured from July to October in each case. The pigs consumed an average of 3.06 and 2.93 lbs. of corn per pound of gain, respectively, in addition to the alfalfa pasture.

The spring pigs pastured in one of the above lots, as in previous years, were allowed to hog off ¼ acre of corn at the completion of that test, whereas the spring pigs from the other lot were allowed to hog off ¼ acre of corn with rape drilled between the rows. Due to grasshopper injury the rape was a failure in 1921. There were 32 pigs in each of the hogging off tests, weighing at the start a total of 2,916 lbs. on corn alone and 1,474 lbs. on corn and rape. The pasturing periods were 18 and 43 days, respectively, and the total gains made were 656 and 754 lbs. As determined by the estimated grain consumed per 100 lbs. of gain, more efficient gains were made on the corn and rape in that 479 lbs. of grain was required for 100 lbs. of gain as compared with 609 lbs. when corn alone was hogged off.

The feeding tests carried on cooperatively with the Montana Experiment Station and previously noted in the report of that station (E. S. R., 49, p. 170) are also reported in detail.

Soft pork investigations, J. M. Scott (*Florida Sta. Rpt. 1922, pp. 26–33*).—The results of two experiments to study the effect of Spanish peanuts on the production of soft pork are reported. For the first experiment 2 lots of 5 pigs each were selected and fed for a period of 44 days. Lot 1 received a ration of equal parts of corn and shorts and one-eighth as much cottonseed meal as the combined weight of the corn and shorts, and lot 2 received peanuts only. During the second feeding period of 44 days with the same lots of pigs, the rations were reversed. Samples of the fat of the pigs were taken for analysis at the start of the test, at the end of 44 days, and at the end of 88 days. The melting points of the samples of fat from lot 1 varied from 26.1 to 26.9° C. at the start, from 34.3 to 36.2° at the end of 44 days' feeding on corn, shorts, and cottonseed meal, and from 34 to 35.8° after 44 days' feeding on peanuts. The melting temperature of the fat from the pigs of lot 2 at the start varied from 23.7 to 25.8° and from 23 to 24° after 44 days on peanuts, and from 27.2 to 28° after 44 days on corn, shorts, and cottonseed meal. The weight of the pigs and iodin numbers of the fat samples were also given.

In the second experiment 2 lots of 11 pigs each were fed as lots 1 and 2 in the above test except that the periods lasted 63 days. The melting points of the fats at the start varied in lot 1 from 28.5 to 35.7° and in lot 2 from 29.2 to 36.2°. At the end of 63 days' feeding on corn, shorts, and cottonseed meal, the melting points varied from 28 to 38°, but after changing the ration to peanuts for a like time the melting points ranged from 25 to 33.2°. By feeding peanuts to lot 2 the melting points were lowered to from 23.1 to 27.4, and after feeding corn, shorts, and cottonseed meal they ranged from 31.3 to 36°. The refractive index and iodin numbers for the fat samples, as well as the weights of the pigs, are also given in the second experiment.

Other studies have shown a marked variation in the melting point of the fat from pigs of the same litter which have received similar feed and care.

The pedigree basis of selecting breeding males for high egg production, F. A. Hays (*Amer Soc. Anim. Prod. Proc. 1922, pp. 79–87, figs. 2*).—Based on the work of Goodale in breeding Rhode Island Reds at the Massachusetts Experiment Station (E. S. R., 48, p. 574), the importance of the male's inherited capacity for egg production is emphasized. In selecting the males it is suggested that the egg records of the 31 nearest dams be taken into consideration. The average first year's production of all daughters of 12 males which have

been used as breeders for two years in the flock was 127±5.376 for the daughters produced in the first year and 121±4.877 for the daughters produced in the second year. Since the probable error of the difference is ±7.258, it is concluded that the production of a sire's daughters is a reliable guide to his value as a breeder.

Fall and winter feeding schedule for Leghorn pullets, Mr. and Mrs. G. R. Shoup (*Western Washington Sta. Bimo. Bul., 11 (1923), No. 3, pp. 61–64*).—This consists mainly of a discussion of the methods of feeding and managing Leghorn pullets. Certain rations for egg production are also suggested.

Studies in egg preservation, D. B. Swingle and G. E. Poole (*Montana Sta. Bul. 155 (1923), pp. 30, fig. 1*).—The results of a comparative study of methods of household egg preservation previously noted (E. S. R., 49, p. 471) are more fully reported. In making the studies, eggs were preserved with water glass in dilutions varying from 1:10 to 1:100, and others were coated with Fresh Egg Keep, Crisco, Snowdrift, lard, lard plus 2 per cent of thymol, and water glass (full strength). The preserved eggs were tested at various intervals as to their physical condition, flavor and odor when soft-boiled, baking qualities, and their bacteriological content.

There was much variation in the keeping qualities of the eggs in different preservatives and in the types of bacteria recovered from the spoiled eggs, but generally speaking water glass in dilutions of 1:25 or 1:50 seemed to be the most uniformly successful preservative. The study brought out rather clearly that bacteria and molds will penetrate the shell of eggs when moistened, but that the dry shell is practically impervious. The greases seemed to prevent evaporation from the egg, but if greased eggs are stored in a damp place bacteria and molds may enter. The water glass acts as a disinfectant, as was demonstrated by its ability to destroy bacteria in a relatively short time.

Directions for household egg preservation are given in detail.

DAIRY FARMING—DAIRYING.

Alfalfa hay as a basis for home-grown rations for milk production, F. B Morrison, R. S. Hulce, and G. C. Humphrey (*Amer. Soc. Anim. Prod. Proc. 1922, pp. 68–72*).—Two feeding trials from the Wisconsin Experiment Station are reported in comparing home-grown rations with rations containing purchased high protein feeds for winter milk production. Both rations consisted of equal amounts of alfalfa hay and corn silage and a grain mixture of home-grown feeds in one case (49.5 per cent of corn, 49.5 of oats, and 1 per cent of salt) and in the other case of some purchased feeds (38.75 per cent of corn, 38.75 of oats, 10.75 of linseed meal, 10.75 of cottonseed meal, and 1 per cent of common salt). The nutritive ratios of the two rations were, respectively, in the first trial 1:7.1 and 1:5.9 and in the second trial 1:6.8 and 1:5.6.

During the first trial 5 cows on the home-grown ration decreased an average of 6.4 lbs. in daily milk production during 21 weeks, whereas the other lot decreased 8 lbs. in the same time. The double reversal method of feeding was employed in the second trial, during which the average daily milk production on the two rations differed by 0.1 lb. in favor of the home-grown ration. The fat percentage, however, was 0.03 per cent less.

The authors conclude that normal winter milk flow may be maintained in fall freshening cows with the home-grown ration provided alfalfa hay is fed liberally, but they do not believe that sufficient nitrogen is supplied for forced production of high records.

[Experiments in dairying at the Florida Station], J. M. Scott (*Florida Sta. Rpt. 1922, pp. 33–36*).—Samples of milk from two cows receiving varying

quantities of fish meal up to all they would eat over a period of six weeks showed no effect of the fish meal feeding on the flavor of the milk.

In another experiment the effect of feeding large quantities of velvet bean meal on the quality of the butter fat produced by cows was studied by making determinations of the melting point, iodin number, saponification number, and Reichert-Meissl number. In making this study samples of milk were taken from two cows while on a normal dairy ration and after changing the ration to one consisting only of velvet bean meal. The melting points and iodin numbers of the butter fat produced from the velvet bean ration were higher than on the normal ration whereas the saponification numbers and the Reichert-Meissl numbers were lower.

In a comparative feeding test for milk production, a ration of 2 parts of ground corn cob and shuck, 2 parts of ground oats, 2 parts of ground velvet beans and pods, and 1 part of peanut meal without hulls gave slightly better results as measured by the milk produced than a ration of wheat bran, corn meal, beet pulp, and cottonseed meal in the proportion of 2 : 2 : 21.5.

Experiments with dairy cattle [at the Huntley, Mont., Reclamation Project Experiment Farm], T. W. Moseley (*U. S. Dept. Agr., Dept. Circ. 275 (1923), pp. 21–27, fig. 1*).—In continuation of the study of the carrying capacity of irrigated pasture (E. S. R., 46, p. 771), 1 acre was pastured for 135 days in 1921, with an average of 1.79 cows per day. In comparing the relative economy of milk production by 4 cows which have completed two comparative lactations, during one of which roughages only (alfalfa hay, silage, and roots) were fed and during the other concentrates were added, the author concludes that under average conditions the milk and butter fat are produced more economically on the roughage ration.

An experiment was started in 1921 to study the effect of a top-dressing of barnyard manure on the carrying capacity of irrigated pastures. It was found that the top-dressed portion was able to carry 1.023 cows per acre for 135 days, whereas the unmanured portion could only carry 0.918 cow per day for a like period.

Feeding and management of dairy calves and young dairy stock, W. K. Brainerd and H. P. Davis (*U. S. Dept. Agr., Farmers' Bul. 1336 (1923), pp. II+18, figs. 7*).—This is a practical discussion of the principles of feeding and managing dairy calves and young stock, with a discussion of milk substitutes, methods of preventing horns, systems of marking, and calf diseases.

Significance of balance in milk production, W. J. Fraser (*Amer. Soc. Anim. Prod. Proc. 1922, pp. 50–54, figs. 3*).—The necessity of maintaining a proper balance between care, housing, and feeding of dairy cattle is emphasized by showing how a little incompleteness in any one of these factors might reduce the returns and largely destroy the profits from the enterprise.

Some factors affecting milk yield, J. Hammond and H. G. Sanders (*Jour. Agr. Sci. [England], 13 (1923), No. 1, pp. 74–119, figs. 18*).—Using 1,410 normal milk records of Shorthorns from the Penrith Milk Recording Society, a study was made of the effect of month of calving, length of the nonpregnant period, lactation (first, second, etc.), and the length of dry period on total yearly milk production.

Data are presented in detail in the form of tables and graphs, and the causes of the effect of each factor are discussed. As regards the effect of month of calving, it was determined that the records of cows calving in January, June, and July were normal, but the yields of those calving in February, March, April, May, and December were 10, 2, 3, 2, and 2 per cent, respectively, too low, and the records of those calving in August, September, October, and No-

vember were 8, 4, 1, and 6 per cent, respectively, too high, and should be corrected accordingly.

The average time of service for the cows studied was 100 days after calving, and this also allowed the cows to again calve about the same time the following year. One hundred days after calving was, therefore, taken as the normal time for service. The influence on production of differences of 20 days earlier or later than this was determined, and it was found that there was a gradual decrease as the time was shortened which amounted to 30 per cent when service occurred within 20 days of calving. There was also a gradual increase in production when the nonpregnant period was longer than 100 days. The production for the cows served from 460 to 499 days after calving was 28 per cent greater than normal.

In making the corrections for the different lactation periods, it was found that maximum production occurred in the fifth and sixth lactations, with decreased production of 4 per cent in the fourth, 10 per cent in the third, 18 per cent in the second, and 30 per cent in the first lactation period. A dry period of 80 to 119 days was taken as normal, with corrections of +13 per cent, +2.5, and —2 per cent, respectively, for periods of less than 39 days, 40 to 79 days, and over 120 days. By applying the suggested corrections for the 4 factors considered to the records studied, the variation was reduced about 20 per cent, 15 per cent of which was due to the correction for lactation period, 3 per cent to the correction for time of service and month of calving, and 2 per cent to the correction for the length of the dry period. The authors call attention to the fact that there are undoubtedly many other factors which influence total milk production.

A bibliography of 70 references is given, most of which are discussed in the paper.

The shape of the lactation curve, H. G. Sanders (*Jour. Agr. Sci. [England], 13 (1923), No. 2, pp. 169–179, figs. 2*).—Based on the data in the paper above, the possible influence of factors affecting the shape of the lactation curve has been studied in order to ascertain whether a cow's lactation curve is due entirely to environmental conditions or whether it is partly due to genetic factors.

In carrying on the work, the author has given a definite numerical value to the shape of the lactation curve of each cow which is called the shape figure (S. F.). In calculating the value S. F., the total yearly milk yield of each cow was divided by her maximum daily yield. The quotient was then divided by the average of like quotients for all the cows calving in the same month. This gave a value for the shape figures varying roughly from 0.5 to 1.5.

The influence of the length of the nonpregnant period, genetic factors, age of the cow, length of the dry period, and general environmental conditions, such as feeding, care, weather, etc., on the shape figure were then studied. The value of the shape figure was found to rise as the length of the nonpregnant period increased. The value was determined by a fitted curve at 0.82 when service occurred within 20 days of calving, and went as high as 1.54 when the cow was not pregnant for 480 to 500 days after calving. The percentage corrections are calculated for the normal on a 100-day nonpregnant period as in the above paper.

To study the influence of heredity on the shape figure, the records of 100 cows with the first three or more lactation records known were studied with and without making the necessary corrections for the length of the nonpregnant period. It was found that the standard deviation of all the corrected records was 0.189±0.0048, compared with 0.122±0.0031, the average of the standard deviations for the shape figures of the records of the individuals

The difference was eight times the probable error. This indicates that the records of individuals tend to be more uniform than the records of the group as a whole, and thus that the shape of the lactation curve depends partly on genetic factors. The same results were obtained, but not such significant differences, by selecting three or four records at random from cows having three and four records, respectively, and comparing the average of the standard deviations calculated from them with standard deviations of the records of individual cows.

In studying the effect of age on the shape of the lactation curve, shape figures were compared for the first and second, second and third, third and fourth, etc., lactations of the same cows. There was found to be a drop of about 11 per cent in the S. F. from the first to the second lactations, but the differences between later lactations were not significant.

No consistent relation was found between the length of the dry period and the shape figure. Low yielders were definitely found to have low-shaped figures and high yielders high ones, as high yield seems to depend on continuance of high production rather than on a high maximum production. The shape figures of the records of high, medium, and low yielding cows in six herds showed that there was considerable variation within the same herds, indicating that while environment may have some effect on the S. F. value, genetic differences are certainly evident.

The inheritance of milk yield and some of its practical applications, J. W. Gowen (*Amer. Soc. Anim. Prod. Proc. 1922, pp. 102–104*).—In studying the influence of parents and grandparents on the milk production of cows, a number of correlation coefficients have been calculated from Holstein-Friesian Advanced Registry 365-day records as follows: Milk yield of full sisters 0.55, half-sisters of the same sire 0.37, half-sisters of the same dam 0.38, daughter and dam 0.41, granddaughter and paternal granddam 0.09, granddaughter and granddam 0.31, granddaughters of paternal grandsires 0.07, and granddaughters of maternal grandsires 0.24, and for butter fat percentages full sisters 0.52, half-sisters of the same sire 0.38, half-sisters of the same dam 0.12, daughter and dam 0.41, granddaughter and paternal granddam 0.09, granddaughter and maternal granddam 0.19, granddaughters of paternal grandsires 0.18, and granddaughters of maternal grandsires 0.22.

The practical conclusions from these constants are that the sire and dam are jointly and equally responsible for milk yields and butter fat percentages, and that the grandparents influence these variables to only about one-half the extent that the parents influence them. The influence of good parents and grandparents and the lack of influence of animals too far back in the pedigree is thus emphasized.

The inheritance of fat content of milk in dairy cattle, W. L. Gaines (*Amer. Soc. Anim. Prod. Proc. 1922, pp. 29–32, fig. 1*).—The percentage fat content of the milk of 47 F_1 and 19 F_2 hybrids between Holsteins and Guernseys from the Bowlker herd (E. S. R., 42, p. 771) is reported. The mean fat content for the F_1s was 4.352 ± 0.026 per cent and for the F_2s 4.439 ± 0.064 per cent, one animal averaging 5.64 per cent.

In analyzing the data according to Castle's method for estimating the number of genetic factors concerned in blending inheritance, it was calculated that 14 factors were involved, but the lack of sufficient population makes this estimate of little value. The author concludes that the limiting factor in milk and fat production is the energy involved. This is more or less constant, thus making the union of high fat and high milk production in the same animal doubtful.

The influence of great sires on their breeds, W. S. Anderson (*Amer. Soc. Anim. Prod. Proc. 1922, pp. 120–122*).—The opportunity of influencing the breed which a great sire has because of the large number of superior offspring which he may produce is emphasized, and the male ancestry of the 410 bulls entered in the 1918 Jersey Registry of Merit is shown to trace to 14 foundation sires. Of the above number of bulls 375 traced to 5 foundation sires.

Register of Merit Jersey sires compared, C. W. Turner and A. C. Ragsdale (*Jersey Bul. and Dairy World, 42 (1923), No. 33, pp. 1693, 1694, 1702, 1703, 1710*).—Register of Merit Jersey sires having 10 or more R. M. daughters have been compared according to the average production of their daughters corrected to mature age (8 years). In correcting the production of the cow, the actual production was multiplied by the average production of all cows at 8 years of age and divided by the average production of all cows at the same age as the cow under consideration.

The ratio of head length to the dimension of certain other parts in Holstein-Friesian cattle, B. E. Pontius (*Amer. Soc. Anim. Prod. Proc. 1922, pp. 110–112*).—Measurements of the length of head, body, and pelvis; distance from pin bones to stifle, and stifle to hock; height at withers, sternum, and hock; width of shoulders and hips; and depth of chest were taken on 60 purebred Holstein cows in two herds at Oconomowoc, Wis. Most of the cows measured had high advanced registry records, but some were large and others were more refined. The relationship of parts, however, was rather uniform, as the coefficients of variability varied only from 2.42 to 5.41 per cent. The correlation coefficients between certain of the parts were not high, but they were statistically significant, indicating a general uniformity among purebred Holstein cattle.

Inspection of milk supplies, E. Kelly and C. S. Leete (*U. S. Dept. Agr., Dept. Circ. 276 (1923), pp. 37, figs. 10*).—This consists mainly of the principles to be observed in inspecting dairy farms and milk plants, emphasizing the importance of inspection as a means of safeguarding human health. The use of the score card is recommended in both cases.

Ninth annual report of the creamery license division for the year ending March 31, 1923, R. L. Hammond (*Indiana Sta. Circ. 111 (1923), pp. 19, figs. 2*).—This is the report of the creamery license division of the dairy department for the year ending March 31, 1923, and includes material similar to that given in previous reports (E. S. R., 47, p. 877).

The bacteriological background of butter making.—I, Butter making: A fermentation industry, G. L. A. Ruehle (*Michigan Sta. Quart. Bul., 6 (1923), No. 1, pp. 24, 25*).—This is a discussion of the importance of the control of bacterial action for the production of the proper quality and flavor in butter.

The manufacture of Camembert cheese, K. J. Matheson and S. A. Hall (*U. S. Dept. Agr. Bul. 1171 (1923), pp. 28, figs. 9*).—The composition and characteristics of Camembert cheese are discussed, followed by a detailed description of the process of manufacture.

The cheese is best made from fresh clean milk containing not less than 3.5 per cent butterfat. One to 2 per cent of an active commercial starter should be employed to ripen the milk to a lactic acid acidity of 0.2 to 0.23 per cent. Three to 4 oz. of rennet are then added per 1,000 lbs. of milk at a temperature of 84 to 86° F., and the milk is allowed to stand for 1 to 2 hours, after which it is ready to dip into hoops containing approximately 2 qt. of the curd. This is allowed to drain at a temperature of from 65 to 70° in a room where the air is moist. On the following day the cheese should be rubbed with salt to help form a rind and favor the development of the

Camembert mold and slime organisms, as well as to prevent the action of putrefactive organisms. The cheese is then inoculated with the mold either by spraying or putting mold in the salt and removed to the curing rooms where it is ripened at from 52 to 58° in a relative humidity of from 85 to 90 per cent. Under normal conditions the reddish slime will spread over the cheese in the course of from 10 to 14 days. The cheese is wrapped at the end of about 2 or 3 weeks in tinfoil or aluminum foil. Each cheese should weigh about 8 oz.

A jelly strength test for judging edible gelatin, T. HALL and R. L. HOUTZ (*Ice Cream Trade Jour., 19 (1923), No. 7, pp. 63, 64, fig. 1*).—An apparatus for testing gelatin is described which depends on the buoyancy of the gelatin body.

Michigan dairy manufacturing plants, J. A. DOELLE (*Lansing: Mich. Dept. Agr., Bur. Dairying, 1922, pp. 12*).—An alphabetical list of the creameries, cheese factories, condensed milk factories, milk plants, and ice cream factories licensed in the State of Michigan up to October 15, 1922, is given.

VETERINARY MEDICINE.

Anticomplementary action of fresh bovine serum, I. F. HUDDLESON (*Jour. Infect. Diseases, 33 (1923), No. 2, pp. 184–192*).—This contribution from the Michigan Experiment Station consists of the report of an investigation of the reason for heating bovine serum at 56° C. for 30 minutes before applying the complement fixation test for contagious abortion.

A preliminary examination for complement of several hundred bovine serums showed none to contain sufficient native complement to interfere with the accuracy of the test. It was found, however, that fresh bovine serum generally contains a complement-binding substance. Further studies showed that the degree of the activity of this substance varies with the serum, that it is reduced markedly in 5 minutes and destroyed completely in 15 minutes at 56°, that the amount of anticomplementary substance taken up in the test depends upon the concentration of the bovine serum and the time of contact between the bovine serum and the guinea pig serum, and that the action is probably due to the interaction between the two serums.

No relation was found to exist between the complement-binding property of active bovine serum and its property to agglutinate sheep corpuscles, nor did bovine serum have any action on complement derived from rabbits and swine.

A study of the normal and immune hemagglutinins of the domestic fowl with respect to their origin, specificity, and identity, C. E. BAILEY (*Amer. Jour. Hyg., 3 (1923), No. 4, pp. 370–393*).—The results obtained in this extensive investigation of the normal and immune hemagglutinins in chicken serum are summarized as follows:

"The red corpuscles of 13 out of 14 animal species here tested were found to be agglutinated by pooled serum from adult chickens. Twelve species of corpuscles were also hemolyzed, the red cells of the pigeon and the goat being the exception. Goat cells were neither hemolyzed nor agglutinated by this serum.

"Isohemagglutinins could not be demonstrated in the active and inactive chicken serum. The specificity of the hemagglutinins in pooled normal adult chicken serum was shown to be relative and not absolute when tested by specific adsorption with red corpuscles of the rabbit, rat, guinea pig, sheep, and goat.

"The time of the appearance of the hemagglutinins in the blood stream of the chicken is as follows: Antiguinea pig about 30 days, antirabbit about 16 days, and antirat about 16 days after hatching. Immune antiguinea pig hemag-

glutinins were stimulated to appear 15 days earlier than the normal antibodies by intraperitoneal injections of the specific antigens. Antirabbit and antirat hemagglutinins were not stimulated to appear any earlier than in the normal by the injections of their specific antigens.

"Normal antiguinea pig and immune antiguinea pig hemagglutinins show one difference in reaction, the normal antibody being adsorbed by rabbit's red corpuscles, while the immune antibody is not."

The blood elements in complement deficient guinea pigs, L. B. NICE, A. J. NEILL, and H. D. MOORE (*Amer. Jour. Physiol., 65 (1923), No. 1, pp. 101–106*).—A comparison is reported of the number of red and white corpuscles and the amount of complement and catalase in the blood of 12 complement-deficient guinea pigs of the strain described by Moore (E. S. R., 43, p. 273) and of 22 normal controls.

The complement-deficient animals were found to have from 37 to 50 per cent fewer red blood corpuscles per millimeter of blood than the normal controls and from 19 to 42 per cent more white corpuscles. The decrease in red corpuscles is thought to explain in part the lowered resistance of the complement-deficient animals to lowered temperature, and the higher number of white corpuscles to indicate a protective device to make up for lack of complement. No relationship was found to exist between the number of white and red blood corpuscles and the amount of catalase in the blood. In the two sets of normal animals used as controls, half of the animals of each set had a low catalase content and the other half a high catalase content.

Serologic agglutination of Bacillus sporogenes, I. C. HALL and N. STARK (*Jour. Infect. Diseases, 33 (1923), No. 3, pp. 240–247*).—From agglutination tests conducted on sera prepared with 19 pure strains of *B. sporogenes* and other similar but not homologous anaerobes, the conclusion is drawn that positive tests identify, but negative tests do not exclude, this particular organism.

Studies on pneumococcus immunity, II, III (*Jour. Expt. Med., 38 (1923), No. 2, pp. 149–182, figs. 5*).—In continuation of the series of studies previously noted (E. S. R., 48, p. 278), two papers are presented.

II. *Active immunization of monkeys against pneumococcus Types II, III, and IV pneumonia with the homologous pneumococcus vaccine,* R. L. Cecil and G. I. Steffen (pp. 149–161).—In three subcutaneous injections of the homologous vaccine, complete immunity was secured with Types II and IV, but with Type III in only four out of the eight monkeys vaccinated. Specific protective bodies against the homologous types could not be demonstrated in the serums of the monkeys in any case.

III. *The nature of pneumococcus antigen,* W. A. Perlzweig and G. I. Steffen (pp. 163–182).—In this study the immunizing properties of fractions obtained by various treatments of virulent strains of pneumococcus were tested on white mice.

Active immunization against many lethal doses of the pneumococcus was secured by two or three subcutaneous injections of the homologous type of pneumococcus saline vaccine. The best results were secured by starting with a very small dose and repeating the inoculation one week later with a larger dose. Immunization was also secured with the protein fraction obtained by treating pneumococci with anhydrous sodium sulphate or by solution of pneumococci in the bile salts and precipitation with alcohol. The antigen proved to be resistant to prolonged autolysis and to tryptic digestion and could be isolated from the tryptic digest with 70 to 90 per cent alcohol. It is insoluble in absolute alcohol, ether, and other lipoidal substances. The immunizing property of slightly acid solutions of the antigen was not destroyed by boiling for five minutes nor by heating at 56° C. for one hour. These results are

thought to indicate that the antigen is nonlipoidal, and that it probably adheres to the protein fraction in a loose chemical or physical union rather than representing a protein complex of a large molecular size.

Immunization against infectious abortion, SCHERMER and EHRLICH (*Vet. Med., 18 (1923), No. 11, pp. 1015–1017*).—An English translation of the article previously noted (E. S. R., 48, p. 880).

The relationship between Micrococcus melitensis and Bacillus abortus of Bang, E. BURNET (*Arch. Insts. Pasteur Afrique Nord, 3 (1923), No. 1, pp. 48–66*).—This is chiefly a review of the literature on the relationship between *B. abortus* and *M. melitensis*, including previously reported work of the author (E. S. R., 48, p. 481) from which he concluded that the only means of distinguishing between the two organisms is in their pathogenicity for monkeys. The probability is suggested in this paper of a similar difference in their pathogenicity for man.

The intracutaneous inoculation of anthrax bacilli, H. VALLÉE (*Bul. Soc. Cent. Mét. Vét., 99 (1923), No. 14, pp. 285–288*).—Attention is called to the observations of Besredka concerning the marked sensitiveness of guinea pigs to intracutaneous inoculation of anthrax bacilli (E. S. R., 44, p. 877), and observations are reported on the effects of a similar inoculation of cattle. Five animals were inoculated in the skin of a subcaudal fold with 0.1 cc. of a virulent culture isolated directly from the bone marrow of cattle dead from anthrax. The injection was followed by an immediate local reaction and later by considerable edema and a rise in temperature. Three animals recovered eventually, and the other two died in 65 and 90 hours, respectively, showing on autopsy the classic picture of anthrax.

[Report of the] department of animal pathology, W. H. DALRYMPLE and H. MORRIS (*Louisiana Stas. Rpt. 1922, pp. 18, 19*).—In investigations of blood-sucking insects as disseminators of anthrax conducted during the year, "anthrax has been transmitted from guinea pigs to other experimental animals by several species of Tabanus. The highest percentage of infections was obtained from *T. quinquevittatus*. They proved to be ferocious feeders upon the horse, or experimental animals. Fifty per cent infections were produced when a single fly was permitted to feed upon an infected guinea pig and afterwards transferred to a healthy one." Several other species were studied with negative results, and some would not feed in captivity.

Agglutination studies of Clostridium botulinum, W. A. STARIN and G. M. DACK (*Jour. Infect. Diseases, 33 (1923), No. 2, pp. 169–183*).—In this investigation of the agglutination and absorption reactions with *C. botulinum*, 4 strains of type A and 2 of type B organisms were tested, as well as strains of 2 other anaerobes, *C. sporogenes* and *C. putrificum*. All the strains employed were descendants of single cells.

For the agglutination tests, attempts were made to immunize rabbits with spores and with young vegetative cells of the organisms. The animals did not tolerate well the injection of the spores, and in no case were antibodies formed. The injection of young vegetative cells was well tolerated and with all but one of the strains yielded agglutinins. There was some variation in the ability of the different strains to stimulate the production of agglutinins, type B of *C. botulinum* and *C. sporogenes* reacting more readily than *C. putrificum* or type A strains of *C. botulinum*. The agglutination tests showed marked specificity for the 2 types of *C. botulinum* and for *C. sporogenes* and *C. putrificum*. In type A there was also evident a distinct subdivision into 4 groups and type B into at least 3 groups.

For the absorption tests massive cultures of several strains of type A and type B were separated from the medium in which they were grown, washed

in salt solution, and finally suspended in a little salt solution and tested with different serums. These tests also showed marked specificity for the 2 types and similar though less marked specificity in the subgroups.

The complement content of the blood of animals suffering from foot-and-mouth disease, G. KNAPP (*Der Komplementgehalt des Blutes von Tieren, die an Maul- u. Klauenseuche Leiden. Inaug. Diss., Univ. Munich, 1921, pp. 11*).—This is a brief report of a study of the significance of the complement fixation test in experimental foot-and-mouth disease. Swine were used as the experimental animals and sheep serum for the hemolytic system. It was found that in swine artificially infected with guinea pig foot-and-mouth disease virus the appearance of the eruption was followed by disappearance of complement. Simultaneous occurrence of blackleg was found not to interfere with the reaction.

Microbic virulence and host susceptibility in paratyphoid-enteritidis infection of white mice, I, II, L. T. WEBSTER (*Jour. Expt. Med., 38 (1923), No. 1, pp. 33–54, figs. 15*).—The investigation of the relationship between microbic virulence and host susceptibility in artificially induced mouse typhoid (E. S. R., 49, p. 281) has been extended to a comparison of six related strains of paratyphoid-enteritidis bacilli, first, with reference to the effect of repeated intraperitoneal passages on the virulence of the several strains and, second, with reference to the equilibrium between the virulence of each strain and the individual and group resistances of the various mice.

The strains employed included Mouse Typhoid I and II of the previous study, *Bacillus enteritidis* (Gaertner), *B. pestis caviae*, *B. aertrycke* (mutton), and *B. paratyphosus* B. Broth cultures of these strains were used in six dilutions of from 1:10 to 1:1,000,000. Two mice were given intraperitoneally 1 cc. of each dilution, and from the heart blood of the first animal to die in each series cultures were obtained to inject in the next series. From 4 to 8 passages were made with each of the six strains.

From the duration of life of the experimental animals no evidence could be obtained of any change in virulence of any of the strains as the result of repeated passages. The different strains were of varied virulence, and this was shown consistently in the various dilutions employed. In all the dilutions Mouse Typhoid I and *B. enteritidis* were most virulent, followed by Mouse Typhoid II and *B. aertrycke*, and finally by *B. pestis caviae* and *B. paratyphosus* B.

In the second part of the investigation the method adopted was the same as that described in the earlier paper, a series of mice being injected per os with a given culture and the process repeated with cultures from the heart blood of the first animal to die. Observations were made on the length of life after injection and the number of survivors after 60 days.

The data obtained show that repeated per os passage did not alter the virulence of the strains. The percentage mortality showed the same differences in virulence of the different strains as was noted in the preceding paper. To determine whether the differences in susceptibility to the several strains indicated a reaction of nonspecific nature, a series of mice received per os varying amounts of mercuric chlorid. The mortality curves for decreasing amounts of this poison showed individual differences in the susceptibility of the mice. The mortality curve following 0.0033 gm. per os of mercuric chlorid was similar in form to the curve for Mouse Typhoid I or *B. enteritidis*, and that following the 0.0025 gm. injection resembled the Mouse Typhoid II and *B. aertrycke* curves.

It is concluded that "the degree of individual host susceptibility as exhibited by the mortality curve is a general property not restricted to the bac-

terial infections which we have been studying, but inclusive of a chemical intoxication as, for example, with mercury bichlorid. It is of importance to know that even when as few as 20 individual mice of a given age and weight, reared alike, are assembled, so small a group will contain individuals highly subject to infection or intoxication, as the case may be, individuals very resistant to the same injurious agencies, and individuals standing between these extremes."

The complement fixation test in tuberculosis, H. L. COULTHARD (*Jour. Path. and Bact., 26 (1923), No. 3, pp. 350–381*).—The investigation reported in this paper consisted (1) of a comparison of the value of various antigens employed in the complement fixation test in tuberculosis as tested with known positive and negative sera from human cases and experimental infections, and (2) a study of the relationship of the complement fixation reaction as thus developed to the extent and progress of tuberculosis infection in man and animals, and of the influence of tuberculin treatment on this reaction.

The antigens tested included preparations of the whole bacillus such as saline, glycerin-saline, and broth cultures of tubercle bacilli and other acid-fast organisms; preparations of tissues rich in tubercle bacilli; and preparations consisting of fractions of the tubercle bacillus extracted by chemical methods. In place of using a fixed dose of complement, varying amounts were used in order to determine the magnitude of the reaction.

Of the various antigens employed, suspensions of killed tubercle bacilli in saline solution were considered to give in general the most marked reactions, with the alcoholic extract of cultures of tubercle bacilli previously treated with acetone next in order. The fats and fatty acids soluble in acetone, the waxes soluble in chloroform, and the proteins extracted by acids and alkalis all proved relatively inert as antigens. Antigens derived from different strains of human and bovine tubercle bacilli showed no marked difference in behavior with a given serum. "Attempts, therefore, to classify tubercle bacilli into subgroups by the method of complement fixation do not promise great success." On the other hand, only slight fixation was obtained with acid-fast organisms other than tubercle bacilli.

In the examination of tuberculous sera from human and experimental infections, the criterion of a positive reaction adopted was as follows: "Those sera are positive which in the presence of the antigen do not allow of complete lysis of the test corpuscles with at least twice the amount of complement required by the negative control serum under the same conditions." The examination, according to this criterion, of the sera of about 400 tuberculous individuals and 150 presenting no apparent lesions, and the following up of the majority of these cases for at least 2½ years has led to the following conclusion:

"The evidence strongly supports the view that, when tuberculous infection has been established, a strongly positive result denotes relatively high immunity irrespective of the extent of the disease, e. g., the marked positive reactions in cases of fibroid phthisis of long standing. On the other hand, weakly positive results are the rule when there is little tolerance to the infection. In general, positive reactions have become weakened whenever subacute processes became manifest, and toward death a negative result was usually obtained."

From a survey of the literature on the application of the complement fixation test to the detection of tuberculous infection in animals and from limited observations on experimental tuberculosis in guinea pigs and rabbits, similar conclusions are drawn concerning the value of the test. "A comparison of the results obtained by the complement fixation reaction with the sera of animals, whether experimentally or naturally infected, with those of human sera shows much in common. Excessive infection is apparently incompatible with vital

response, while more moderate infection elicits after a varying period an active response in the form of antibody production, the intensity of which depends on the individual's tolerance to the infection."

Catarrhal garget, J. W. KALKUS (*Western Washington Sta. Bimo. Bul., 11 (1923), No. 3, pp. 59–61*).—This is a brief account of this affection, its cause, symptoms, and treatment.

Isoanaphylaxis in cattle producing serum against rinderpest, G. CURASSON (*Rev. Gén. Méd. Vét., 32 (1923), No. 378, pp. 302–307, fig. 1*).—Attention is called to several cases resembling acute anaphylaxis, with fatal results, among cattle being hyperimmunized for rinderpest serum. The symptoms and lesions noted are described, evidence is furnished that anthrax, hemorrhagic septicemia, piroplasmosis, and trypanosomiasis were not involved, and the reasons for considering the condition as isoanaphylaxis are summarized.

Further studies on the susceptibility of swine to bovine infectious abortion, I. F. HUDDLESON (*Michigan Sta. Quart. Bul., 6 (1923), No. 1, pp. 25–28*).—A brief report is given of a further study on the susceptibility of swine to bovine abortion.

Ten virgin pigs about 10 weeks of age and from a source where swine abortions had not occurred were divided into two groups, one of 4 and the other of 6 animals. The first group was placed in the barn lot with 16 head of dairy cattle, 5 of which had previously aborted and 3 were known to be carriers of *Bacterium abortus*. The animals of the second group were placed in a separate inclosure and were given the regular ration of feed with milk from the same herd, with the addition after breeding of from 50 to 200 cc. of heavy suspensions of virulent strains of *B. abortus* of both bovine and porcine origin, the organisms being administered at periods of from 1 to 15 days. Three of the animals had received before breeding two injections of abortion vaccine, the first of killed and the second of living organisms. The animals in both groups were bred to negative-reacting boars. Agglutination and complement fixation tests were made from time to time.

All of the animals in the first group farrowed normally and gave negative blood tests throughout the experimental period. Of the other group, 1 only of the vaccinated animals developed positive agglutination and complement fixation tests, while 2 of the unvaccinated animals developed a positive reaction to the complement fixation test only. There was no indication of abortion or abnormal farrowing in any of the animals.

It is concluded that while it is possible to infect swine by inoculation, they are not at all susceptible to infection under natural conditions, and that the feeding of infected milk or the association of swine with cattle infected with *B. abortus* should not be considered dangerous as far as the possibility of infecting swine is concerned.

Mutation among hog cholera bacilli, M. L. ORCUTT (*Jour. Expt. Med., 38 (1923), No. 1, pp. 9–15*).—From observations made on a number of strains of *Bacillus suipestifer*, the true hog cholera bacillus, it is concluded that under certain conditions mutation occurs with the development of a type which is quite different from the original form. These types have been designated A for the original and B for the mutant. If cultures of type A are kept without transplantation mutation to the B type occurs, while if rapid transplantation is followed the A type is retained. Type B tends to remain true to type except under conditions of rapid successive passages through bouillon, when it may revert to type A.

Type A forms on agar even, smooth colonies producing uniform clouding in bouillon with no sediment, while type B forms irregular, granular colonies producing a sediment in bouillon. In 0.85 per cent salt solution the A type

gives a stable suspension, while the B type is completely agglutinated. In acid agglutination reactions type A was found to give an incomplete reaction between pH 3.2 and 1.6, while type B gave complete clumping between pH 3.2 and 1.8.

Normal rabbit serum agglutinated type A only in low dilutions, but agglutinated type B completely at 1:320 or 1:640. Similar results were obtained with normal guinea pig serum. In agglutination absorption tests, however, the A and B types were found to be related, absorption of a normal serum with either type leading to the removal of agglutinins of both types. Type A proved more virulent for mice than type B.

Diseases of poultry, B. A. GALLAGHER (*U. S. Dept. Agr., Farmers' Bul. 1337 (1923), pp. II+41, figs. 15*).—This summary of information supersedes Farmers' Bulletin 957, previously noted (E. S. R., 39, p. 686).

Inoculative treatment of diphtheritic roup, F. CLEMENT (*Vie Campagne, 20 (1923), No. 237, pp. 90–93, figs. 6; trans. in Natl. Poultry Jour., 3 (1923), No. 149, pp. 638–640, figs. 5*).—The author discusses the causes and general symptoms of diphtheritic roup in fowls and outlines the method he employs in curative and preventive inoculation. This consists in keeping the infected with the healthy birds, and inoculating the former with from 3.5 to 5 cc. of avian antidiphtheritic serum and the latter with about half this amount of serum. In the more severe cases the treatment is repeated from 5 to 8 days later. It is also recommended that the poultry houses be disinfected frequently with a 5 per cent solution of cresol or lysol, and that iron sulphate (1 gm. to 1.5 pints of water) be added to the drinking water.

From reports received concerning results obtained with the serum inoculation, it is concluded that the serum is very efficacious when dealing with birds affected for the first time, less efficacious when used on farms in which the disease recurs yearly, and useless when employed on birds which have had a chronic form of the disease. The serum treatment is considered effective in dealing with swollen eyes, if the cases are treated immediately after the first appearance of the symptoms, but is without effect in dealing with advanced and serious eye cases.

The relation of faulty nutrition to the development of the epithelioma contagiosum of fowls, R. MCCARRISON (*Brit. Med. Jour., No. 3266 (1923), pp. 172–174, pl. 1*).—The author reports the occurrence of contagious epithelioma in pigeons under conditions indicating that faulty nutrition was an important causative factor.

Polyneuritis was induced in a number of pigeons by the exclusive feeding of polished rice. Twelve of the pigeons were cured at the height of the disease by the feeding of green food (mung dal), and 48 hours after the disappearance of the symptoms were placed in an open-air pen with 60 healthy stock birds, having access to a food mixture containing a sufficiency of vitamins. In spite of the fact that the birds continued to improve in general condition, 7 out of the 12 developed chicken pox or canker in from 6 weeks to 3 months, while the 60 birds of the healthy stock remained well. That the virulence of the virus was not great was shown by the failure to induce the infection in 6 other healthy pigeons by the inoculation of material from the nodules of the infected birds.

The development of the disease is considered to be due to a combination of factors, including "lessened bodily vigor, which favored the occurrence of injury or abrasion of exposed parts and the entry into the body of a growth-inducing virus; the fortuitous presence in the pigeon pen of an invisible virus possessing the property of inducing infiltrative new growth of epithelium; and an abnormal state of metabolism, with disorder of endocrine function,

favorable both to the entry of this virus into the body and to its activity therein." It is thought that a like combination of factors may be responsible for the development of other epithelial growths.

Allergins due to Bacterium pullorum and to B. sanguinarium, C. Truche and A. Urbain (*Compt. Rend. Soc. Biol. [Paris], 88 (1923), No. 17, pp. 1275, 1276*).—Evidence is presented that the serum of rabbits immunized with *B. pullorum* or *B. sanguinarium* contains a high count of antibodies. These can be detected by an antigen consisting of an emulsion of the microorganisms either alive or killed by alcohol-ether. The latter is said to have the higher antigenic value and to be the more specific.

RURAL ENGINEERING.

A study of alkali and plant food under irrigation and drainage, C. W. Botkin (*New Mexico Sta. Bul. 136 (1923), pp. 44, figs. 11*).—Studies on the effects of irrigation and drainage on the alkali salts and plant-food constituents of certain soils at the station are reported.

The results showed that a condition of impermeability developed on leaching, with distilled water, an adobe soil containing about 1 per cent of white alkali as sodium chlorid. Where percolation was good this large amount of white alkali was readily removed and leached below the toxic limit by a small amount of water. The chlorids were more readily removed than any other constituent.

Practically no phosphoric acid was lost in the drainage water, but about 40 per cent of it was changed into a form not readily soluble in n/5 hydrochloric acid. Approximately 80 per cent of the water-soluble potash disappeared on leaching. A considerable portion of it was apparently retained in an insoluble form. Approximately 50 per cent of the nitrogen was retained in the soil mixture after leaching, the remainder being probably lost in the drainage water. After toxic amounts of alkali were removed by leaching, the water-soluble solids remaining consisted chiefly of plant nutrient materials. The forces of adsorption and chemical combination were apparently greater for the plant nutrients than for the white alkali.

Leaching of the soil mixture caused a large increase in water-soluble materials, a large part of which was chlorin. Calcium showed a greater increase in solubility than the other metallic constituents. This increase is attributed to chemical action and possibly in part to absorbed materials which are rendered soluble by the drying of the moist soils.

Moduling of irrigation channels, E. S. Crump (*Punjab Irrig. Branch Papers, No. 26A (1922), pp. [I]+12+IX, pls. 3*).—A general description of water measurement devices for irrigation canals and the factors influencing their operation and accuracy is given, together with a mathematical description of their theory and practical data covering their use. These include submerged orifices, weirs and combinations thereof, and adjustable weirs. Detailed drawings of adjustable proportional weirs are included.

Pumping for irrigation, L. N. McClellan (*Reclam. Rec. [U. S.], 14 (1923), No. 6, pp. 202–208, figs. 4*).—Technical information on pumping for irrigation as it is practiced on projects of the U. S. Reclamation Service is summarized.

Air-lift pumps, J. A. Coombs (*Soc. Engin. (Inc.) Trans., 1922, pp. 20–29, pl. 1, figs. 3*).—Technical information on the fundamental theory of the construction and operation of air-lift pumps is presented.

The economics of arterial land drainage, C. H. J. Clayton (*Soc. Engin. (Ins.) Trans., 1922, pp. 205–232, fig. 1*).—The fundamental principles governing the economics of land drainage are discussed in this report.

Drainage assessments: Their imposition and their collection under the North Carolina drainage law, F. NASH (*N. C. Geol. and Econ. Survey, Drain. and Reclam. Div. Circ. 4 (1922), pp. 11*).—The duties of State and county officers relative to the imposition and collection of drainage assessments under the North Carolina drainage law are briefly outlined in this circular.

Mechanical testing, R. G. BATSON and J. H. HYDE (*New York: E. P. Dutton & Co., 1923, vol. 2, pp. XI+446, pls. 67, figs. 234*).—This is the second volume of this treatise (E. S. R., 48, p. 589), which is a number of the so-called Directly-Useful Technical Series, edited by J. L. Bale. It deals with methods and apparatus used for the testing of prime movers, machines, and structures. An effort has been made to confine the work to descriptions of mechanical methods of testing, except in certain cases of importance where hydraulic, electrical, or optical means are employed in conjunction with mechanical procedure. Available types of testing apparatus for standard tests are also described. Chapters are included on dynamometers and dynamometry; absorption dynamometers; transmission dynamometers; dynamometer testing plant for internal combustion engines; gear testing—efficiency tests; springs; the mechanical testing of lubricants; friction tests on bearings; vibration tests; tests of static and dynamic balance; tests on concrete slabs; tests on concrete and reinforced concrete beams; columns and struts; measurement of the movement of masonry structures due to vibration and subsidence, and of the stresses and deflections produced in structures under dead load, impact, etc.; tests on cutting tools; apparatus for applying and measuring hydraulic pressure; tests with aircraft models; and miscellaneous tests and testing apparatus.

Economic motor-fuel volatility, S. M. LEE (*Jour. Soc. Automotive Engin., 13 (1923), No. 1, pp. 3–15, figs. 28*).—This paper is a progress report supplementing a report by Carlson, previously noted (E. S. R., 48, p. 885), on the subject, and covers further investigations made by the U. S. Bureau of Standards to secure data for use as a basis for estimating the effect of a change in the gasoline volatility on the fuel consumption of automotive internal-combustion engines now in service throughout the United States.

The tests reported were conducted with four fuels of different characteristics under winter conditions. Observations were also made on an engine which was set up and operated in the laboratory under test conditions.

The results of the winter road tests were found to be in general agreement with those of the summer tests reported by Carlson. The laboratory tests showed that under conditions of low speed and temperature more of a less volatile fuel was required to give a maximum power mixture, or to operate at all, than of a more volatile fuel. No large differences in fuel consumption of the high and low volatile fuels were observed in constant speed tests. The greatest difference observed was much less than the difference between the estimated possible productions of the two fuels.

It is concluded that the difference in volatility existing between the two fuels is not so large as to produce considerable differences in fuel consumption in existing automotive engines, at least under conditions of constant speed and load. Crank case dilution tests showed that the rate of dilution was greater with the less volatile fuels under all conditions of tests. In general, it was found that the circulating-water temperature has the greatest single influence upon the rate of dilution and that the mixture ratio has a considerable effect.

Winter tests show lower mileage with heavy fuels, H. C. DICKINSON and J. A. C. WARNER (*Jour. Soc. Automotive Engin., 13 (1923), No. 1, pp. 87–92,*

figs. 3).—Fuel consumption studies conducted in connection with the above investigation, covering summer and winter conditions, are reported.

These showed that under winter conditions there is a small but definite increase in average fuel consumption of about 30 per cent, accompanying an increase of about 55° in the 90 per cent point of the distillation curve of the fuels. Taken by itself, this relatively small difference in consumption is considered to be unimportant compared with the estimated difference in the relative amounts of the two extreme grades of fuel obtainable from a given quantity of crude oil. Differences in starting and general performance corresponded with the relative volatilities of the fuel in the range of from 15 to 20 per cent of the distillation curve. The uninstructed drivers chose the fuels having the highest and the lowest distillation temperature in this range with remarkable consistency, notwithstanding the small existing differences.

The use of acetone in composite engine fuels, R. F. REMLER (*Jour. Soc. Automotive Engin., 13 (1923), No. 1, pp. 23, 24*).—In a contribution from the Mellon Institute of Industrial Research, a summary of data from various sources on the use of acetone in engine fuels is presented.

The data indicate that acetone alone is an excellent fuel, easy to start with, does not freeze at the coldest winter temperature, and will not detonate under a pressure of 180 lbs. per square inch. It can be mixed in all proportions with various automotive fuels and produces a uniform mixture when added in varying amounts to a number of immiscible liquids. When it is added in small amounts to heavy hydrocarbon fuels it minimizes the deposition of carbon and tends to prevent fuel knocks. Acetone is said to be the most economical solvent of acetylene and, if saturated with this gas and added to composite engine fuels, will produce a smooth running mixture, facilitate starting, and permit running on a leaner mixture.

Memorandum on solid lubricants ([*Gt. Brit.*] *Dept. Sci. and Indus. Research Bul. 4 (1920), pp. 28*).—This is a summary of information, prepared by T. C. Thomsen, on the nature, manufacture, and use of, and results obtained from such solid lubricants as graphite, talc, soapstone, mica, flowers of sulphur, and white lead. Special attention is given to the use of graphite as a solid lubricant, and particularly in a deflocculated condition, in oils. A summary of data from various tests on the effectiveness of solid lubricants in different machines is also presented.

It is noted that the use of solid lubricants for the internal lubrication of internal combustion engines has given numerous contradictory results, with particular reference to carbon formation and sooting of spark plugs. No difficulty apparently is experienced in small engines, and some data indicate less sooting of plugs when using colloidal graphite. The results as a whole indicate the desirability of using only a small amount of graphite in oil, usually less than 0.35 per cent. Opinions appear to be unanimous that when using graphite internal combustion engines start more easily and with greater freedom.

Truck operating costs, B. H. PETTY (*Purdue Univ., Engin. Expt. Sta. Bul. 10 (1923), pp. 45, figs. 8*).—This bulletin reports the results of a survey of truck operating costs in Indiana begun in November, 1921, and includes a simple presentation as to how and why a truck operator should record operating cost data. An analysis of the factors governing motor truck operating costs is given, together with a description of systems for recording operating cost data.

An investigation of some heavy-duty truck drive axles, S. VON AMMON (*Jour. Soc. Automotive Engin., 12 (1923), No. 6, pp. 517–534, figs. 36*).—Studies conducted by the U. S. Bureau of Standards on the mechanical efficiency of

a number of heavy-duty truck axles, representing the several types in successful use, are reported.

It was found possible to separate power losses into no-load losses and load losses, the total loss being the sum of these two. In general, the no-load losses were controlled primarily by the viscosity and the method of application of the lubricant. They were greater in those axles in which the parts rotating at high speeds were immersed almost completely in the lubricant. Where a separate body of lubricant was used in the wheels the losses were increased still further. In a given axle, these losses also increased with an increase in the viscosity of the lubricant and with the propeller shaft speeds.

The load losses, expressed as torque, were practically independent of the speed and of the viscosity and the method of application of the lubricant. They increased, however, with an increase of the torque input and at an increasing rate. In the case of several worm type axles tested, the increase in the load losses with an increased torque input was greater than with any of the gear type axles.

It is concluded that the use of a lubricant of a lower viscosity at low temperatures would improve the mechanical efficiency under the more unfavorable conditions of speed and temperature, and would seem advisable. Improvement in the method for circulating the lubricant is suggested as desirable, as the high no-load losses of some of these axles show the present method of circulation to be very inefficient. The characteristic difference between the worm drive and the gear drive types was demonstrated by the greater load losses of the former type.

The general-purpose farm tractor, C. M. Eason (*Jour. Soc. Automotive Engin., 12 (1923), No. 6, pp. 597–609, figs. 27*).—The author divides the history of the application of mechanical power to farm work into three periods, reviews each, and comments upon the various phases of progressive development that influence the type of tractor most desirable for satisfying present needs. The requirements of farm work are outlined, and the different types of tractor built and being constructed to meet these demands are reviewed, including a discussion of large v. small tractors, type of drive, power needed, control, methods of operation, and the factors constituting general-purpose service.

So far as adopting the tractor for farm usage is concerned, the author believes that the present limitation of such utilization lies with the tractor industry and with tractor engineers rather than with the farmer.

Insulated and refrigerator barges for the carriage of perishable foods, A. Ewing et al. ([*Gt. Brit.*] *Dept. Sci. and Indus. Research, Food Invest. Bd. Spec. Rpt. 15 (1923), pp. III+21, figs. 3*).—The results of an investigation of insulated and refrigerator barges for carrying perishable foods are presented.

It is concluded that an efficiently insulated barge not provided with refrigerating machinery is suitable for the conveyance of frozen cargo in cold weather, and that with an atmospheric temperature of 50° F. and sea water at 51° frozen cargo, loaded at 20°, with the chambers at 50°, will carry with safety for 48 hours without precooling or other refrigeration. Further tests showed that with the same atmospheric and sea-water temperatures and with chambers precooled down to from 18 to 20°, frozen cargoes can be carried with safety for 96 hours without any further refrigeration, provided all chambers are fully stowed. It was also found that with an atmospheric temperature of 76° and sea water at 73°, precooling is effective for 40 hours only, where no refrigeration is utilized after loading.

Air cooled storages for Michigan apples, R. E. Marshall and F. E. Fogle (*Michigan Sta. Quart. Bul., 6 (1923), No. 1, pp. 15–20, figs. 4*).—A detailed

description is given of an apple storage house which is said to have been a decided commercial success in Michigan for nine years. Detailed drawings are included.

Live stock equipment for Wyoming, F. S. HULTZ (*Wyo. Farm Bul., 11 (1923), No. 3, pp. 30, figs. 28*).—Working plans for various types of equipment required on a live stock ranch or farm are presented and briefly discussed. These include hog, dairy-cow, and poultry equipment.

Tests of self-supporting barn roofs, A. W. CLYDE (*Agr. Engin., 4 (1923), No. 7, pp. 107–109, 118, figs. 5*).—In a contribution from the Iowa State College, the results of a number of tests of self-supporting barn roofs are reported.

In a preliminary test four models of Gothic rafters were subjected to a concentrated load applied at the center, thus producing severe shearing stresses. It was noted that a bending moment of 2,650 ft.-lbs., corresponding to the influence of a 60-mile wind on a 36-ft. barn, was not reached until the load was over 1,000 lbs. The outstanding feature of the bent rafters was their flexibility. Even a slight slippage between the pieces permitted considerable deflection and small loads produced permanent deflections. This is taken to indicate that it will be extremely difficult, if not impossible, to nail or bolt these rafters together well enough to prevent such deflection. Tests of braced rafters to determine the influence of wind-bracing below the plate led to the conclusion that such bracing is necessary in order to relieve the roof of wind stresses and to permit of more exact analysis of the stresses in the rafter proper. Tests of a modified Shawver truss, which is usually considered to be a statically indeterminate structure, showed that this truss, when properly modified, is susceptible of accurate design. The conclusion is drawn that little real engineering knowledge has ever been used in barn roof design, with special reference to the joints and splices.

Silage and silo construction for the Maritime Provinces, J. A. CLARK (*Canada Dept. Agr. Pamphlet 35, n. ser. (1923), pp. 24, figs. 17*).—Practical information on silo construction and silage making, with particular reference to conditions in the Maritime Provinces of Canada, is presented in this pamphlet.

Cost accounting in stave silo erection, MACHANSON (*Concrete [Detroit], 22 (1923), No. 6, pp. 211–214*).—Methods of cost accounting in stave silo erection are presented, together with data showing the distribution of expenses on actual work.

House construction that reduces heating costs, J. D. HOFFMAN (*Purdue Univ., Engin. Ext. Serv. Bul. 2 (1923), pp. 20, figs. 11*).—Practical information on the planning and construction of dwelling houses to prevent the excessive loss of heat from heating systems is given in this bulletin.

Sewage disposal for rural homes, H. W. RILEY and J. C. MCCURDY (*N. Y. Agr. Col. (Cornell) Ext. Bul. 48, rev. (1923), pp. 59–81, figs. 22*).—This gives practical information on methods of disposing of sewage from country homes.

RURAL ECONOMICS AND SOCIOLOGY.

[Results of cotton and corn demonstrations], S. STEWART (*Louisiana Stas. Rpt. 1922, pp. 34, 35*).—The hours of labor required for specific operations in planting, cultivating, and harvesting a 12-acre field of cotton and two fields of corn of 14 and 10.25 acres, respectively, at the North Louisiana Station are tabulated here. The totals given indicate 695.5 man hours, 182.5 boy hours, and 307 mule hours required on the cotton demonstration at a total cost of $166.19. Those for the first of the two corn demonstrations are 424 mule hours and 534.5 man hours at an expense of $120.04. The totals for the second corn

demonstration are 160 mule hours, 175 man hours, 30 boy hours, and total expense of $64.22.

Facilities provided by law for the acquisition of rural small holdings (*Vie Agr. et Rurale, 21 (1922), No. 27, p. 33*).—Provisions by law for long-term loans for the purchase of homes and gardens, the operations of special agricultural credit societies, and other sources of public aid in acquiring small holdings in France, all of which are included under the administration of the French Ministry of Agriculture and the Ministry of Hygiene, Aid, and Insurance, are briefly reviewed.

Land reform in Czechoslovakia, J. Macek (*Slavonic Rev., 1 (1922), No. 1, pp. 144–150*).—Land reform measures passed in 1918, 1919, and 1920, dealing with the expropriation of large estates for the establishment of small holdings, the compensation allowed to the former landlords, and the sources of the credit advanced by the State, are discussed in these pages.

A bill with regard to large holdings and credit for land improvement, D. Taruffi (*Atti R. Accad. Georg. [Florence], 5. ser., 19 (1922), No. 2–4, pp. 147–164*).—A bill concerned with the expropriation of large holdings and home colonization in Italy is reviewed critically. Provisions which it carries for financing the development of small farms, irrigation works, and roads, and the official bodies through which the improvement and control would be administered, are set forth.

Report of the committee on agricultural credit, T. G. Chambers et al. (*London: Min. Agr. and Fisheries, 1923, pp. 39*).—The committee appointed October 13, 1922, for the purpose of inquiring into the adequacy of the credit facilities available for agriculturists in Great Britain makes its report in these pages.

With reference to long-term credit it is recommended that the Improvement of Land Acts should be amended to authorize any association operating thereunder to charge such rate of interest as the departments concerned may approve, and that the Lands Improvement Company, an institution for advancing loans on estates, first established in 1853, should be urged to consider the advisability of wider publicity. It is considered further that those farmers who purchased their holdings between the dates of the enactment of the Corn Production Act of 1917 and its repeal should be enabled to obtain loans by an approved society under State supervision, such loans not to exceed 75 per cent of the present value of the holding concerned and to be repayable within a period of 40 years on an annuity basis. Funds for this purpose should be advanced in the first instance by the Public Works Loans Board and subsequently by the issue of guaranteed stock.

With regard to short-term and immediate credit it is recommended that the State should urge the immediate formation of agricultural cooperative credit societies and should place the capital sum at the disposal of each society on the basis of £1 for each £1 of share capital raised by the society, of which not less than 5s. in the pound must be paid up. These societies should be affiliated through the Ministry of Agriculture or the Board of Agriculture for Scotland, allowed to receive deposits, and given free discretion as to the granting of loans to members for agricultural purposes. It is suggested that the State funds for this purpose should be derived from a portion of the amount gained by the sale of saving certificates in rural areas.

A reservation to the committee's report with regard to short-term credits is made by H. M. Conacher.

The prevailing customs for the assignment of value for improvements at the time of a change in contract, D. Taruffi (*Atti R. Accad. Georg. [Florence], 5. ser., 19 (1922), No. 2–4, pp. 97–108*).—The increase in the value

of livestock and other farm equipment since the war has led to difficulties over the division of the increase between landlord and tenant upon the termination or renewal of the contract. It is generally conceded that the unusual increment due to the war conditions should be divided equally except under particular conditions, when a maximum of 60 per cent in favor of one or the other party is granted. Various formulas for determining the differences are given.

Agricultural profits and the taxes paid by agriculturists, QUEUILLE (*Vie Agr. et Rurale, 21 (1922), No. 51, pp. 445, 446*).—A brief review is given of the situation of French farmers as regards their profits since the war and the taxes they pay. Certain commercial groups are said to be contending that farmers are not contributing equitably to the Government in the way of taxes, and it is attempted to show that in proportion to their profits since the war their taxes have not been too light.

The rise of our marketing problem and how we are meeting it, J. F. BOOTH (*Sci. Agr., 3 (1923), No. 6, pp. 203–211*).—This article consists of three parts dealing, respectively, with the history of the problem of selling farm surplus, the reasons for the middleman system, and the service which may be expected through farmers' cooperative societies.

The marketing of Kentucky blue grass and orchard grass seeds, D. G. CARD (*Kentucky Sta. Bul. 247 (1923), pp. 33–61, figs. 6*).—This bulletin describes the methods of handling these seed crops on the farm, marketing, grades, and possible improvements in the industry. It is pointed out that the blue grass seed industry particularly lends itself favorably to cooperative marketing because the seed is produced in comparatively limited areas in Kentucky and Missouri. It is held that the opportunities in cooperative marketing are primarily those of economy and improvement in the demand for the seed.

Great Britain and the world's live stock industry.—I, Beef and mutton. II, The Vestey interests, C. J. BRAND (*U. S. Dept. Agr. [Packers and Stockyards Admin.], 1923, pts. 1, pp. 20; 2, pp. 42*).—This mimeographed report in two parts describes in the first place the meat production in the principal European countries, Argentina, and the United States from the point of view of supplying the needs of Great Britain, and in the second place the cold storage and meat packing interests consolidated there under one firm and other enterprises relating to it.

Weather, Crops, and Markets (*U. S. Dept. Agr., Weather, Crops, and Markets, 4 (1923), Nos. 9, pp. 217–240, figs. 2; 10, pp. 241–264, figs. 5; 11, pp. 265–296, figs. 3; 12, pp. 297–320, figs. 2; 13, pp. 321–344, figs. 2*).—Tabulations and charts recording the temperature and precipitation in the United States during the weeks ended August 28 and September 4, 11, 18, and 25, 1923, are given in these numbers, together with general and local summaries of weather conditions. In addition to the usual reports on receipts and prices and the position in the market of important classes of agricultural products and specific commodities and cold-storage reports, there appears in No. 9 a summary of the cost of production of corn, wheat, and oats on farms in the United States in 1922. The net cost per bushel of corn with 3,363 records was 66 cts., of wheat $1.23 on the basis of 2,417 records, and of oats 53 cts. with 2,601 records. No. 11 contains the report on estimated crop conditions for September 1 and the farm value tables for August 15 and September 1.

Cold storage holdings (*U. S. Dept. Agr., Statis. Bul. 1 (1923), pp. 32*).—This is the first of a series of statistical bulletins to be published from the regular monthly reports made to the former Bureau of Markets and the Bureau

of Agricultural Economics. It was prepared under the direction of J. O. Bell. The work of collecting statistics of cold-storage holdings was begun in October, 1914, and has been gradually enlarged. The tabulations here show the refrigerator space in public and private cold-storage plants and meat-packing establishments and in the leading cities. Data are presented which indicate the quantities frozen monthly and the cold-storage holdings of such specific commodities as apples, creamery butter, cheese, eggs, poultry, beef, lamb, and mutton, pork, lard, and numerous kinds of fish.

A study in rural community organization, J. H. KOLB (*Amer. Jour. Sociol., 29 (1923), No. 1, pp. 34–41*).—In this paper certain phases of the investigation of rural primary groups in Wisconsin, previously noted (E. S. R., 46, p. 894), are discussed.

Generalizations are made to the effect that rural society like other forms of societies is made up of social groups which are constantly changing, making necessary adjustments in social organization and institutions, and that the rural population is always in a service relation to the nearby city, town, or village. Community organization consists of this mesh of organized and changing relationships. It is urged that the farmer requires a larger community organization in order to meet the demands upon him for efficiency, and the implications are that the town must specialize in those services which it can render to the farmer most efficiently, and that the farmer in turn must assume a keener responsibility for these larger community units instead of holding effectively to a family or a neighborhood group economy.

Sedgwick County, Kans.: A church and community survey, B. Y. LANDIS (*New York: G. H. Doran Co., 1922, pp. X+11–83, figs. 23*).—This is one of the three studies in the Town and Country Series previously noted (E. S. R., 49, p. 94), which deal exclusively with one particular county as a rural geographical and political unit. Emphasis is placed upon the conditions of mutual dependence and aid existing between the farm population and the city of Wichita and the villages of the county.

There were 53 active Protestant churches in the town and country areas of this county in 1919 and 1920, when the survey was made, each of which owned its own building. They were served by 41 pastors. Six churches were pastorless.

A chapter is devoted to an account of the work of the Federated church at Waco, Kans.

In general, the assets of the churches were found to be good, and there was little unchurched territory in the county. In 30 out of 52 Sunday schools there was a larger enrollment than in the churches of which they form a part, which condition was due to a certain extent to the fact that while the children of tenant farmers attend the Sunday school their parents do not belong to the church. Recommendations are drawn up with reference to this and other neglected groups, recreational programs, the supplying of more resident ministers, federation, training for leadership, financial systems, church organizations, and other opportunities for improving the church situation.

The church on the changing frontier: A study of the homesteader and his church, H. O. BELKNAP (*New York: G. H. Doran Co., 1922, pp. XVI+17–143, figs. 54*).—This one of the series noted above is a study of the work of Protestant city, town, and country churches in Beaverhead County in Montana, Sheridan in Wyoming, Union in New Mexico, and Hughes in South Dakota, these having been chosen as typical of large sections throughout the range area.

Data are presented which indicate the history, equipment and finances, membership, services and church organization, Sunday schools, young people's societies, and community programs. Intensive investigation was limited to the

distinctly rural areas and to those centers of population which have less than 5,000 inhabitants. Appendixes contain a descripton of the survey methods used and definitions, as well as tabulated major facts as revealed by the investigation for each county.

Community work among the Pimas, W. D. Owl (*South. Workman, 52 (1923), No. 7, pp. 331–336, figs. 4*).—An account is given of recreational and religious leadership among the Pima Indians in Arizona, their life and environment being essentially rural.

The cooperative movement in Sweden, A. Börjessen (*Irish Econ., 8 (1923), No. 2, pp. 113–118*).—This is a statement covering briefly the functions and activities of various typical farmers' cooperative societies in Sweden.

The agricultural syndicate of the districts of Chartres, Chateaudun, and Nogent-le-Rotrou (*Syndicat Agricole des Arrondissements de Chartres, Chateaudun, et Nogent-le-Rotrou. Chartres: Impr. Durand, 1921, pp. 112*).—The history is given of a long established and influential cooperative agricultural organization in France. Its principal lines of activity have been the purchase of fertilizers, the training of agricultural teachers, the giving of courses and demonstrations in agriculture, and the supplying of credit to members.

Report of the Royal Commission of Inquiry into Farming Conditions, W. J. Rutherford et al. (*Regina, Canada: Govt., 1921, pp. 70, pl. 1, figs. 10*).—An investigation was carried out in 1920 in southwestern Saskatchewan covering the grazing land situation, including the need, advantages, and possibilities of community grazing areas; the control and prevention of soil drifting and the reclamation of drifting soils; the desirability and possibility of moving settlers from inferior to better lands; a system of farm management adapted to the region; the need for further investigation and experimental work, and the methods of experimentation best suited to the conditions; and the means and methods of extending agricultural knowledge throughout the country.

In this report of the commission, statistics of precipitation and crop production through a period of years have been assembled, and a description is given of the methods of cultivation in practice, irrigation development, dairying, the condition of grazing lands, soils, noxious weeds, and the experimental work carried on in Saskatchewan. The system of farm management recommended includes the keeping of live stock, the management of grazing lands and pastures, the practice of summer fallow, the growing of feed and fodder crops, and other items. Other parts of the report give the recommendations of the commission with reference to other phases of the investigation.

The agrarian problem in Hungary, A. Daniel (*Slavonic Rev., 1 (1922), No. 1, pp. 151–171*).—Improvements in agricultural methods effected in Hungary since 1900 and the possibilities of irrigation and land reclamation are noted. An historical résumé of the agitation for land reform, mainly in the way of the breaking up of the latifundia, is given. The agrarian policy of the Hungarian Soviet Government, which existed from March to August, 1919, is said to have aroused the distrust of the majority of the agricultural population. Since the downfall of the Soviet dictatorship the gentry have become allied with the large landlords, although the peasants still demand some land reform. In a law passed in the autumn of 1920 expropriation of large estates was abandoned, but all properties which had been bought during the war were taken over by the State, and a certain amount of land is to be acquired, the whole to be divided among the war victims, agricultural laborers, and public officials.

The large farms between Paris and the Beauce district, F. Évrard (*Ann. Géogr., 32 (1923), No. 177, pp. 210–226*).—These pages are descriptive of the

agriculture typical of the region southeast of Paris, setting forth the buildings and equipment, the important crops, methods of cultivation, and the market for the products of the large farms found there.

The cost of living and rural cooperation, A. Delos (*Ann. Gembloux, 29 (1923), No. 4, pp. 97–126*).—Comparisons are made between the costs of producing wheat and sugar beets in Belgium in 1912 and in 1922, and estimates of the cost in 1922 of raising horses on the farm are given. Examples are also given indicating the profit to the producer of marketing livestock through cooperative packing houses. A number of typical cooperative abattoirs and sugar factories are discussed from the point of view of their rôle in the economic development of rural sections under the present conditions of high producing costs to the farmer.

The agricultural situation in Algeria, G. Bureau (*Vie Agr. et Rurale, 22 (1923), No. 13, pp. 205–208*).—Notes are given on the conditions prevailing, mainly in 1921–22, with reference to the principal crops grown, mutual credit and cooperation, and means of improving agriculture and the livestock industry.

The agricultural possibilities of Cameron's Highlands, Pahang, W. N. Sands (*Malayan Agr. Jour., 10 (1922), No. 10–12, pp. 269–280*).—The agricultural possibilities of a plateau region in the State of Pahang, Federated Malay States, are reported upon here. The opinion is expressed that the areas described are suitable for starting certain tropical industries under plantation conditions.

Statistical annual of Chile.—VII, Agriculture, 1918–19 and 1919–20 (*An. Estadís. Chile, 1918–19, Sect. VII, pp. [7]+134; 1919–20, Sect. VII, pp. [5]+136*).—Data with reference to acreage and production are tabulated as noted for an earlier year (E. S. R., 43, p. 295).

Agricultural statistics, 1921 and 1922, R. J. Thompson ([*Gt. Brit.*] *Min. Agr. and Fisheries, Agr. Statis., 56 (1921), Nos. 1, pp. 1–47; 2, pp. 49–83; 3, pp. 85–136; 57 (1922), Nos. 1, pp. 1–49; 2, pp. 51–89; 3, pp. 91–133*).—These reports present statistics of acreage and numbers of livestock, production, and prices and supplies of produce in England and Wales, as noted for earlier years (E. S. R., 44, p. 792; 45, p. 596).

[Agricultural statistics in Denmark] (*Statis. Aarbog Danmark, 27 (1922), pp. 35–55; 28 (1923), pp. 34–55*).—Statistical reports on the valuation of agricultural property, acreage, and crop production in the later years are added to the series previously noted (E. S. R., 46, p. 496).

The development of the agriculture of Morocco, A. Girard (*Vie Agr. et Rurale, 22 (1923), No. 14, pp. 221–226, figs. 2*).—A summary is given of statistics of crop acreage and production and of livestock for the years 1918 to 1921, inclusive.

The agricultural and commercial statistics for 1921, K. Hirata (*Japan Dept. Agr. and Com., Agr. and Com. Statis., 1921, pp. [4]+176*).—This is a compilation of statistics of agriculture, commerce, manufacturing, fisheries, mining, and forestry for Japan for 1921, with summaries for about 10 years previous.

AGRICULTURAL EDUCATION.

Vocational agriculture in secondary schools, A. K. Getman (*Ed. Rev., 66 (1923), No. 2, pp. 103–106*).—The factors deemed indicative of the need for agricultural instruction are the migration from farms to cities and villages; the demand of modern agriculture upon training in scientific agriculture; and the high percentage of farm boys in the enrollment of the rural high schools, the number of boys and young men in most rural communities who left school

at a comparative early age, and the boys in towns and cities who wish to prepare for farming. It is held that the outlook of a rural high school should be broad, and that ideally, industrial, agricultural, home making, and commercial subjects should be included in both rural and urban schools since the individual interests and aptitudes of the pupils may indicate the need for these subjects in either type of school. The apparent remedy for the financial difficulties of including strong agricultural departments in some of the small rural high schools and in most city schools is to establish special county, district, or State schools of agriculture. With regard to the organization of the teaching content, it is said that principles are important but that effective teaching is to be expected only when a teaching situation involves elements common to those found in the life activities for which preparation is being given. It is suggested that an advisory board of practicing farmers appointed by the board of education may render valuable assistance in organizing agricultural courses.

A comparative study of instruction in consolidated and one-teacher schools, J. M. FOOTE (*Jour. Rural Ed., 2 (1923), No. 8, pp. 337–351*).—Field data were secured for this study in the spring and assembled in the fall of 1921, and the tabulations were made in 1922. Nineteen widely distributed States sent in reports, ranging in number from 3 schools for Illinois to 71 for Iowa. The number of pupils tested was 10,999 for the consolidated schools and 4,653 for the one-teacher schools, which figures are based on the reports for rate of reading. The following conclusions are reached:

Pupils in the one-teacher school are 0.14 year younger than are those in the consolidated school. The holding power of the consolidated school is superior to that of the one-teacher school in the upper grades. The rate of progress from grade to grade is very nearly equal in the two schools, pupils advancing about as rapidly in one type as in the other. There is a significant difference in the results of instruction in each grade tested in favor of the consolidated school. When the grade-achievement differences are converted into terms of yearly progress, they range from 18 to 40 per cent of a year in favor of the large type of school, with a general median difference of 27 per cent. The subject-achievement differences range from 10 to 44 per cent, with a general median difference of 27.5 per cent. The greatest differences are found in rate and quality of handwriting; comprehension of reading takes next rank. The smallest difference is in arithmetic. The grade-achievement differences increase from grade to grade, being distinctly larger in the 3 upper than in the 3 lower grades. The age-achievement differences are in favor of the consolidated school. When converted into terms of yearly progress the age-achievement differences range from 13 to 56 per cent of a year, with a median of age medians of 33 per cent. The age-achievement differences increase with the advancing ages. Five of the 14 administrative facts tabulated compare important conditions. Two favor each type of school by insignificant amounts. The fifth, qualifications of teachers, is decidedly in favor of the consolidated school.

Report on the Agricultural Instruction Act, 1921–22 ([*Canada Dept. Agr.*], *Rpt. Agr. Instr. Act, 1921–22, pp. 54*).—A résumé is given of the work performed under this act for Canada during the first nine years of its operation, 1913–1922.

The administration of agriculture and agricultural education in Norway, O. T. BJANES (*World Agr., 3 (1923), No. 2, pp. 243–246, figs. 3*).—This brief article is descriptive of county agricultural societies, experiment stations, agricultural schools, training schools for agricultural teachers and the higher agricultural officials, instruction for women, and the cost and value of agricultural education.

Agricultural education and rural life in Denmark, R. KAMPP (*World Agr., 2 (1922), No. 4, pp. 177–179, figs. 4*).—This article briefly describes the Danish people's high schools, agricultural schools, and the Royal Agricultural College in Copenhagen.

The International Federation and the International Office for the Development of Home Economics Education, 1908–1922 (*Fedération Internationale et Office International pour le Développement de l'Enseignement Ménager, 1908–1922. Fribourg, Switzerland, 1922, pp. 23*).—In this publication is given a brief account of the history and activities of the International Office and of the International Federation for the Development of Home Economics Education, with statutes and rules for the international congresses, together with lists of members of the permanent international committees and publications received by the office at Fribourg.

Third International Congress of Household Economy Instruction, Paris, April, 1922 (*Internatl. Inst. Agr. [Rome], Internatl. Rev. Sci. and Pract. Agr., 13 (1922), No. 1, pp. 11–16*).—Announcement is made by the International Federation for the Development of Home Economics Teaching, which has its central office at Fribourg, Switzerland, of the Third International Congress held in Paris, April 18–21, 1922, with an exhibition of equipment, material, and methods. A summary is given of the resolutions of the first congress held at Fribourg in 1908 and of the second at Ghent in 1913.

Home economics and international relations, E. A. WINSLOW (*Jour. Home Econ., 14 (1922), No. 8, pp. 389–392*).—An account is given of the sessions of the Third International Congress on Home Economics referred to above.

Table service and etiquette for the home, C. H. PLUNKETT (*Arkansas Sta. Bul. 188 (1923), pp. 21, figs. 5*).—Fundamental principles of table etiquette, family type table service, and service for special occasions are set forth in these pages.

MISCELLANEOUS.

Work and expenditures of the agricultural experiment stations, 1921, E. W. ALLEN, E. R. FLINT, and J. I. SCHULTE (*U. S. Dept. Agr. [Rpt.] Work and Expenditures Agr. Expt. Stas., 1921, pp. V+138*).—This report consists mainly of a discussion of the activities of the stations, including a condensed summary arranged by subjects of the more outstanding results of their work during the fiscal year ended June 30, 1921, and a list classified by subjects of the publications of the stations during the year. The usual detailed statistics as to the organization, revenues, additions to equipment, and expenditures of the stations are included.

For the fiscal year, the total income reported by the stations from all sources was $7,660,570.77. This amount includes $1,440,000 derived from Federal sources under the Hatch and Adams Acts and $210,000 appropriated by the Federal Government for the experiment stations in Alaska and the insular possessions. The support of the stations from within the States included $3,786,997.94 derived from State appropriations or apportionments, $359,964.92 from fees, $1,167,856.62 from the sale of farm and other products, $371,421.86 from miscellaneous sources, and $534,329.43 carried over as balances from the previous year.

During the year the stations added equipment aggregating $992,308.03 and classified as follows: Buildings $459,644.38, library $29,023.53, apparatus $67,598.63, farm implements $107,490.62, livestock $147,229.36, and miscellaneous $181,321.51.

In the work of administration and inquiry the stations employed 1,965 persons. Of these, 1,023 were also members of the teaching staffs of the colleges and 434 assisted in the various lines of extension work.

The stations issued 830 publications during the year, including annual reports, bulletins, circulars, press bulletins, etc., aggregating 20,148 pages. These were distributed to nearly 900,000 addresses on regular mailing lists, in addition to the numbers sent in response to requests, which show constant increase.

A classified list of projects carried on by the agricultural experiment stations, 1922–23, E R. FLINT (*U. S. Dept. Agr., States Relat. Serv., 1923, pp. 2+XIII+364*).—This is a revision, in multigraphed form, of the list previously noted (E. S. R., 47, p. 397).

The work of the Huntley Reclamation Project Experiment Farm in 1921, D. HANSEN (*U. S. Dept. Agr., Dept. Circ. 275 (1923), pp. 27, figs. 2*).—The experimental work reported is for the most part abstracted elsewhere in this issue. Data are also summarized as to climatic conditions, acreage, yields, and farm values of crops produced on the project and the number of livestock.

Annual Report of Florida Station, 1922, W. NEWELL ET AL. (*Florida Sta. Rpt. 1922, pp. 75+VI, figs. 12*).—This contains the organization list, a financial statement for the fiscal year ended June 30, 1922, a general review of the work of the station during the year, and departmental reports, the experimental features of which are for the most part abstracted elsewhere in this issue.

Thirty-fourth Annual Report of Louisiana Stations, 1922, W. R. DODSON ET AL. (*Louisiana Stas. Rpt. 1922, pp. 47*).—This contains the organization list, a financial statement regarding the Federal funds for the fiscal year ended June 30, 1922, and the State funds for the fiscal year ended December 31, 1922, and a report by the director, including brief departmental reports. The experimental work reported is for the most part abstracted elsewhere in this issue.

Quarterly Bulletin of the Michigan Experiment Station, edited by R. S. SHAW and E. B. HILL (*Michigan Sta. Quart. Bul., 6 (1923), No. 1, pp. 38, figs. 14*).—In addition to articles abstracted elsewhere in this issue, this number contains the following: Wheat as a Hog Feed, by G. A. Brown; Treatment for the Bean Weevil, by R. H. Pettit; Agricultural Conditions in Kalamazoo County, by M. M. McCool; and Two Important Northern Michigan Soil Types, by M. M. McCool and J. O. Veatch.

Bimonthly Bulletin of the Western Washington Station (*Western Washington Sta. Bimo. Bul., 11 (1923), No. 3, pp. 50–64, fig. 1*).—In addition to articles abstracted elsewhere in this issue, this number contains brief articles entitled Agricultural Fair Exhibits; Select Seed Potatoes Now, by H. D. Locklin; and The Place of Vetch in Fall Cropping, by M. E. McCollam.

NOTES.

Connecticut State Station.—An experimental curing barn has been completed at the Tobacco Substation at Windsor. This barn is of standard size but divided into four sections, each of which is provided with a different type of ventilation in order to study shed construction and control of curing in sheds. Work has also been begun on a laboratory and office building which will include a glasshouse for investigations in tobacco problems and a sorting room.

Roger B. Friend has been appointed research assistant in entomology, effective January 1, 1924.

Florida Station.—Robert E. Nolen has been appointed graduate laboratory assistant in plant pathology and will devote his time primarily to the study of pecan diseases, in cooperation with the plant pathologist and with the pecan culturist recently added to the staff.

Purdue University and Station.—A sheep barn of modern type has recently been erected at the Moses Fell Annex farm operated by the station at Bedford. This building is 62 by 28 ft. in size. The inclosed part includes lambing quarters and provides space for grain storage. The open shed, 42 ft. long, has a capacity for feeding 125 sheep and can be divided into three separate pens. It has storage space for 20 tons of hay, and a 60-ton silo is attached. There is also a feedway along the front which can be used as a runway for lambs. The building is equipped with lights and running water and has an asbestos shingle roof, concrete foundations, and a concrete floor in the inclosed portion.

Director G. I. Christie has been appointed a member of the Indiana Deep Waterways Commission. This commission was established by the last legislature for the purpose of cooperating with other organizations in furthering the project of linking the Great Lakes with the Atlantic Ocean by a waterway available for ocean going vessels.

Sigfried M. Hauge has been appointed research assistant in animal nutrition, Dr. Frank P. Mathews assistant in the department of veterinary science for both experimental and extension work, and Miss Meta E. Martin assistant in the home economics extension division.

Michigan College and Station.—Dr. Harrison R. Hunt, professor of biology at the University of Mississippi, has been appointed head of the department of zoology in the college and animal geneticist in the station.

Minnesota University.—A recent issue of *Minnesota Farm Review* announces that a bequest in 1918 by the late Caleb Door of $50,000 to the College and School of Agriculture to be used in financing fellowships, scholarships, prizes, and a student loan fund will be at least doubled. Under a provision of the will granting certain real estate to the city of Minneapolis for an aquarium, the diversion of this property to the university was provided in case the city failed to utilize the gift within five years. This period has now elapsed without action. The property is estimated to be worth between $50,000 and $70,000 and will now be used for the same purposes as the original bequest to the university.

Mississippi College.—W. F. Lusk, head of the department of agricultural education, has resigned to engage in farming and has been succeeded by V. G. Martin.

Montana College and Station.—Earl N. Bressman, assistant professor of agronomy and assistant agronomist, resigned December 31 to become associate professor of agronomy and associate agronomist in the Oregon College and Station.

Cornell University and Station.—Reference has already been made (E. S. R., 49, p. 602) to the dedication of the new dairy building. This building consists of a main structure 63 by 170 ft., with three stories and basement and a one-story annex, one part being approximately 80 ft. square and another 113 by 177 ft. In the main building are located offices, lecture and class rooms, and laboratories for testing the composition of milk and other dairy products and work in bacteriology. The annex contains laboratories for teaching the handling of milk and the manufacture of its products, including butter, ice cream, condensed and powdered milk, and casein. Adequate facilities are also provided for research.

North Dakota College.—Richard C. Miller has been appointed assistant professor of agricultural engineering, effective January 1, 1924.

Ohio State University.—The department of agricultural engineering has devised a portable belt-recording dynamometer, which is claimed to be the first of its kind in this country. This apparatus is expected to be of much value in studying the power requirements of threshers, silage cutters, and other machines. A series of tests has already been completed in threshing oats and wheat, baling straw, and cutting silage, and a study of the power consumption of a corn shredder and a soy bean thresher has been begun.

Pennsylvania College and Station.—A fruit packing shed 30 by 60 ft. is to be built at the college orchard. The packing room is to be equipped with modern grading and sizing appliances, enabling considerable practice to be given students in commercial methods.

Dr. J. F. Shigley has been appointed assistant professor of veterinary science vice Dr. I. D. Wilson, resigned.

Tennessee University and Station.—New buildings recently completed at the Cherokee Farm include a horse barn 32 by 40 ft., a tool barn 30 by 90 ft., a 3-story horticultural barn 36 by 44 ft., a 5-room dwelling for the foreman of the horticultural department, and a potato storage house 20 by 20 ft.

N. D. Peacock, who has been in charge of the horticultural work of the College of Agriculture, has been made associate professor of horticulture. T. D. Harden has been appointed assistant chemist in the station vice Hanvey Stanford, resigned to go into business. C. E. Asbury, L. R. Cagle, and B. B. Bird have been appointed teaching fellows in horticulture, entomology, and agricultural economics, respectively.

Virginia College and Station.—R. E. Hunt, professor of animal husbandry and animal husbandman, was transferred to full time teaching duties on October 15. On the same date, C. R. Nobles was appointed assistant animal husbandman in the station. F. S. Glassett has resigned as assistant agronomist and has been succeeded by M. S. Kipps. O. P. Strawn and P. C. Manley have been appointed superintendents, respectively, of the Henry and Augusta County Substations, the latter vice E. R. Hodgson, resigned.

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INDEX OF NAMES.

Aamodt, O. S., 750, 840, 841.
Abbot, C. G., 207.
Abbott, C. E., 600.
Abbott, J. B., 726.
Abbott, R. C., 504.
Abdérhalden, E., 358, 766.
Abel, E., 64.
Abrams, D. A., 384.
Abt, G., 110.
Ackerman, A. J., 354.
Adam, D. B., 437.
Adams, J. F., 243.
Adams, J. J., 497.
Adams, J. M., 292, 692.
Adams, O. V., 588.
Adinarayan Rao, K., 122.
Adlersberg, D., 159.
Afanassjewa, M., 126.
Afonso, P. C., 16.
Agduhr, E., 378.
Agee, H. P., 35.
Ager, 588.
Agnew, M. A., 492.
Ahmed, M., 191.
Ainslie, G. G., 154, 655, 656.
Ajrekar, S. L., 839.
Albano, I., 331.
Albertoni, I., 570.
Albertz, H. W., 629.
Albright, C. C., 687.
Alden, C. H., 851.
Aldrich, J. M., 453.
Aldrich, P. I., 370.
Alexander, C. P., 652.
Alexander, J., 206.
Allard, H. A., 326.
Allder, C. T., 737.
Allen, A. H., 589.
Allen, E. W., 200, 492, 596, 707, 800, 897.
Allen, H. B., 797.
Allen, J., 608.
Allen, K., 262.
Allen, R. F., 45.
Allen, R. H., 150.
Allison, F. E., 217.
Allison, J. H., 196.
Alphandery, E., 762.
Alsberg, C. L., 258.
Alter, D., 615.
Alway, F. J., 200.
Amerman, C. H., 699.
Ames, C. T., 222, 428.
Ames, J. W., 625.
Ammon, S. von, 888.
Amos, A., 264.
Amstel, J E. van, 511.
Anders, C. B., 222, 234, 298, 428.
Anderson, A. C., 416.
Anderson, A. K., 498.
Anderson, B. G., 134.
Anderson, B. M., jr., 604.
Anderson, E. G., 632.
Anderson, F. P., 800.
Anderson, G. H., 764.
Anderson, J. P., 647.
Anderson, L., 804.
Anderson, M. L., 447.
Anderson, O. G., 51.
Anderson, R. J., 201, 309.
Anderson, W. S., 164, 273, 878.
Andrew, R. E., 233.
Andrews, T. M., 409.
Angelo, E., 140, 199.
Anthony, E. L., 199.
Appleman, C. O., 332, 832.
Arbogast, G., 297.
Arbos, P., 390.
Archibald, J. G., 167.
Arkley, L. M., 186.
Arloing, F., 769.
Arloing, S., 278.
Armitage, H. M., 496.
Armstrong, E. F., 308.
Armstrong, G. M., 26.
Armstrong, R. P., 197.
Arndt, C. H., 519.
Arnett, A. M., 93.
Arnett, C. N., 167, 168, 170, 172.
Arnold, C. R., 189.
Arnold, G. F., 352.
Arnold, J. W., 718.
Arnold, L., 263.
Arnquist, J., 96.
Arnstein, H., 387.
Arny, A. C., 431.
Arpin, 135.
Arrhenius, O., 213, 619, 811.
Artom, C., 161.
Artschwager, E. F., 348, 646.
Asbury, C. E., 900.
Ashbaugh, V. J., 75, 276.
Ashbrook, F. G., 471.
Asher, C. D., 207.
Ashley, W. J., 388.
Åslander, A., 738.
Aston, A. E., 287.
Aston, J. G., 277.
Atack, A. H., 513.
Atack, F. W., 202.
Atkins, W. R. G., 520, 845.
Atkinson, A., 800.
Atkinson, E. L., 285.
Atwater, H. W., 597.
Atwood, M. V., 595.
Auchinleck, G. G., 342.
Auden, H. A., 503.
Austin, R. H., 809.
Awschalom, M., 126.
Ayers, E. L., 396.
Ayres, W. E., 225.
Ayyangar, C. R. S., 34.
Ayyangar, G. N. R., 34.
Azzi, G., 738.

Babé, E., 334.
Bachmann, F., 677.
Bacon, M. E., 231.
Bacon, P. E., 276.
Baerg, W. J., 253, 554.
Bagg, H. J., 567.
Bagley, B. W., 588.
Bagué, J., 270, 283, 379, 586.
Bailey, C. E., 879.
Bailey, C. F., 734.
Bailey, C. H., 831.
Bailey, D. L., 196, 840.
Bailey, E. M., 124, 233.
Bailey, J. W., 495.
Bailey, L. H., 104.
Bailey, V., 250, 448.
Baird, A. B., 50.
Baird, J., 441.
Baker, C. E., 754.
Baker, H. J., 197, 800.
Baker, H. R., 482.
Baker, O. E., 200.
Baker, W. M., 837.
Bakke, A., 275.
Bal., D. V., 122.
Balasubramanyam, M., 128.
Baldwin, B. T., 662.
Baldwin, I. L., 19, 636.
Bale, J. L., 887.
Ball, A. E., 251.
Ball, C. R., 389, 492, 596, 634.
Ball, E. D., 492, 596.
Ball, N. G., 519.
Ballantyne, S., 734, 809, 832.

Ballard, E., 155., 556.
Ballou, F. H., 298, 338.
Balls, W. L., 331.
Bally, W., 255.
Balozet, L., 400.
Baly, 820.
Banerjee, S. C., 322.
Bang, N. O. H.–, 170.
Bang, O., 783.
Banks, N., 652.
Banta, A. M., 567.
Barber, E. R., 52.
Barber, M. A., 55.
Bardsley, J. H., 197.
Barker, B. T. P., 38, 40, 45, 48.
Barker, H. D., 134, 196, 600.
Barnes, C. T., 756.
Barnett, E., 267, 465, 469, 869.
Barnett, M., 65.
Barnum, C. C., 136.
Barre, H. W., 299.
Barrett, C. S., 295.
Barrett, J. T., 846.
Barrett, L. L., 591.
Barrows, E. L., 197.
Barss, H. P., 546, 547.
Bartell, F. E., 505.
Bartholomew, L. K., 749.
Bartlett, H. H., 523.
Bartlett, J. M., 218, 233.
Bartolucci, A., 67.
Barton, E. A., 856.
Bassett, H., 308.
Bassi, E., 541.
Bastin, H., 45.
Batchelor, H. W., 722.
Batchelor, L. D., 438.
Bates, C. G., 535.
Batson, R. G., 887.
Bauch, R., 222.
Baunacke, 842.
Baur, F., 718.
Baver, L. D., 198.
Baxter, D. V., 446.
Bayliss, W. M., 109.
Baylor, A. C., 194.
Baynes, E. H., 373.
Beach, S. A., 104, 196.
Beals, E. A., 509.
Bean, R. P., 214, 223, 247, 270, 284.
Beanblossom, W. E., 697.
Bear, F. E., 737.
Beath, O. A., 476.
Beattie, J. H., 436, 487.
Beattie, W. R., 833.
Beaudette, F. R., 197.
Beaufreton, M., 797.
Beaumont, J. H., 437.
Bechdel, S. I., 472.
Bechhold, H., 811.
Becker, K. E., 221.
Becker, R. B., 397, 698.
Beckerich, A., 145.
Becraft, R. J., 198.
Bedale, E. M., 762.
Bedford, H. W., 758.
Bedford, W. L., 845.
Bedson, S. P., 562.
Beek, W. F. van, 781.
Beery, P. G., 801.
Beeson, C. F. C., 84.
Beeson, M. A., 420, 434.
Begemann, 841.
Behrends, F. G., 290.
Belknap, H. O., 893.
Bell, A. G., 600.
Bell, D. S., 269.
Bell, J. O., 893.
Belling, J., 567.
Belyea, H. C., 761.
Benedict, F.G., 256.
Benedict, S. R., 160, 859.
Bengtson, I. A., 255.
Benirschke, F., 205.
Benner, C. L., 98.
Bennett, C. W., 48, 846.
Bennett, H. H., 616.
Bennett, W. J., 207.
Benskin, E., 838.
Bent, A. C., 756.
Benton, J. R., 492.
Berend, 839.
Berezhkov, R. P., 450.
Berg, A., 199.
Berg, R., 802.
Berg, W. N., 78.
Berge, R., 481.
Berger, A., 836.
Bergh, O. H., 72.
Bergquist, S. G., 720.
Berl, E., 110.
Berlinck, E. L., 315.
Berry, P. A., 374, 677.
Berry, R. A., 782.
Bertrand, G., 221, 520.
Besley, F. W., 239.
Bessemans, A., 481.
Bessesen, D. H., 162.
Besson, L., 718.
Bethke, R. M., 198.
Beumée-Nieuwland, N., 16.
Bewley, W. F., 146, 647.
Bezssonoff, N., 213, 805.
Bianchi, A., 565.
Bidwell, G. L., 675.
Biedma, P. C., 171.
Biehler, W., 112.
Bierbaum, K., 684.
Bigelow, W. D., 115.
Bingham, E. C., 287.
Bingham, H. C., 273.
Binney, T. H., 716.
Bioletti, F. T., 248.
Birch, R. R., 481.
Bird, B. B., 900.
Bisby, G. R., 645.
Bishopp, F. C., 356.
Bizzell, J. A., 321.
Bizzell, W. B., 711, 799, 800.
Bjanes,O. T., 896.
Black, J. D., 488.
Black, R. A., 179.
Blackman, V. H., 753.
Blackmon, G. H., 600.
Blair, A. W., 813.
Blair, G. Y., 416.
Blair, W. G., 33, 331.
Blakeslee, A. F., 567.
Blanchard, V. F., 847.
Blanck, E., 123, 414.
Blanco, G. W., 206.
Blaringhem, L., 228, 736.
Blauch, L. E., 492.
Bleile, A. M., 459.
Bliss, R. K., 800.
Blizard, J., 688.
Blood, P. T., 138.
Blunck, 252.
Bly, R., 610.
Boardman, H. L., 800.
Boas, J. E. V., 165.
Bobilioff, W., 626.
Boerger, A., 839.
Boeuf, F., 31, 36, 130, 736.
Bogart, M. T., 498.
Bogdanov-Kat'kov, N. N., 555.
Boischot, P., 123.
Bolling, G. E., 275, 277, 700.
Bonacorsi, L., 680.
Bondorff, K. A., 804.
Bondy, F. F., 156.
Bonnevie, K., 567.
Boock, E., 262.
Booth, C. J., 834.
Booth, J. F., 892.
Booth, N. O., 138.
Boothby, W. M., 57.
Boquet, A., 480.
Borak, J., 764.
Börjessen, A., 894.
Bornemann, 210.
Börner, 252.
Börngen, 66.
Borradaile, L. A., 756.
Bose, J. C., 820.
Bosinger, A. J., 496.
Boswell, V. R., 137.
Bosworth, T. J., 380.
Botkin, C. W., 886.
Botsford, R. C., 299.
Boughton, I. B., 382, 481. 684.
Bouska, F. W., 176.
Bouyoucos, G. J., 617.
Bovell, J. R., 133.
Bowen, J. W., 824.
Bowes, H. G., 283.
Bowman, H. E., 277.
Bowstead, J. E., 670.
Boyce, J. S., 43, 351, 755.
Boyenval, L., 261.
Boyer, L., 168, 175.
Boyle, J. E., 693.
Bracken, A. F., 828.
Bracken, J., 491.
Bradfield, R., 503.
Bradfute, O. E., 706.
Bradlee, T., 800.

Bradley, O. C., 787.
Bradley, W. G., 657.
Brainerd, W. K., 875.
Brand, C. J., 892.
Brandes, E. W., 47, 647.
Branstetter, B. B., 542.
Bray, C. I., 87.
Bray, G. T., 609.
Bray, M. W., 409.
Breakwell, E., 329.
Breazeale, J. F., 519.
Bremer, G., 822.
Brereton, W. LeG., 546.
Bressman, E. N., 900.
Brethour, J. E., 267.
Brewster, J. F., 614.
Bricault, C., 277.
Bridges, C. B., 266, 567.
Bridré, J., 480.
Bridwell, J. C., 760.
Brierley, W. B., 753.
Brigden, A. E., 492.
Briggs, G., 432.
Briggs, I. A., 196.
Brigham, R., 596.
Brightman, M. H., 498.
Brink, J. E., 848.
Brioux, C., 111, 512.
Briscoe, C. F., 420.
Brison, F. W., 140.
Brittain, W. H., 50, 153, 557, 758, 850.
Britton, W. E., 233, 356, 534, 660, 742.
Brody, S., 73, 283, 374, 375.
Broerman, A., 586.
Brokaw, W. H., 800.
Brooks, C. E. P., 412.
Brooks, C. F., 207, 718.
Brooks, E. C., 99, 497.
Brooks, S. D., 799.
Brooksbank, H., 165.
Brotherton, W., 741.
Brown, B. E., 324.
Brown, B. F., 497.
Brown, E. B., 431.
Brown, E. W., 479.
Brown, G. A., 80, 898.
Brown, H. B., 226.
Brown, H. D. (Ontario), 216.
Brown, H. D. (Ind.), 636.
Brown, L. A., 567.
Brown, L. L., 790.
Brown, N. A., 250.
Brown, N. S., 331.
Brown, P. E., 210, 318, 724, 810.
Brown, P. T., 498.
Brown, W., 240, 520.
Brown, W. R., 265.
Browne, C. A., 200.
Brownell, (Mrs.) F. D., 190.
Bru, P., 381.
Bruce, A., 322, 617.
Bruce, D., 642.
Bruce, E. A., 377.
Bruce, H. D., 287.
Brues, C. T., 450.
Bruette, W. A., 373.
Brumpt, E., 400.
Bruner, S. C., 737.
Brunnich, C., 558.
Bruno, A., 217.
Brunton, L. A., 827.
Bruyn, H. L. G. De, 242.
Bryan, K., 383, 587.
Bryan, K. V., 611.
Bryan, O. C., 35, 200, 600, 619, 623, 722, 825.
Bryce, G., 45, 255, 342, 518.
Bryden, C. L., 202.
Bryden, C. T., 798.
Buchholz, J. T., 425.
Buchner, E. F., 796.
Buckle, P., 212.
Buckler, C. W., 297.
Bufalini, E., 282.
Bugnion, E., 454.
Buller, A. H. R., 645.
Bulmer, L. C., 277, 700.
Bunyard, E. A., 834.
Bureau, G., 895.
Burger, O. F., 838.
Burgess, A. F., 852.
Burgess, P. S., 370, 804.
Burgwald, L. H., 175.
Burke, A. D., 377.
Burke, E., 116, 129, 166, 750.
Burke, G. W., 588.
Burke, R. T. A., 415.
Burlison, W. L., 243, 431.
Burnet, E., 881.
Burnett, E. A., 798, 800.
Burr, W., 192.
Burr, W. W., 527.
Burri, R., 607.
Burrows, E. N., 687.
Burt, B. C., 131.
Burton, E. F., 308.
Bushnell, J. W., 137, 198.
Bushnell, L. D., 381.
Bushnell, T. M., 616, 721.
Butcher, F. D., 853.
Butler, E. A., 252.
Butler, O., 328, 349, 350, 351, 651.
Butler, W. J., 175.
Butterfield, K. L., 95, 596.
Butterworth, J. E., 95.
Buxton, C. R., 694.
Bynum, E. K., 761.
Byrne, C. D., 198.

Caesar, L., 558, 848.
Cagle, L. R., 900.
Caldwell, J. S., 411.
Call, L. E., 518.
Calvert, E. B., 207, 718.
Calvert, E. G. B., 408.
Calvin, H. W., 695.
Calvino, M., 334, 737.
Camburn, O. M., 277, 699.
Cameron, T. W. M., 499.
Camp, A. F., 650, 821.
Campanile, G., 150.
Campbell, A. W., 203, 285.
Campbell, C., 40, 542.
Campbell, G. R., 579.
Campbell, R. H., 837.
Campbell, W. G., 200.
Cannon, H. C., 161.
Cannon, P. R., 561.
Canz, 83.
Capinpin, J. M., 238.
Capot-Rey, R., 389.
Carbery, M., 734.
Card, D. G., 293, 892.
Card, L. E., 673.
Card, T. A., 458, 766.
Carlson, A. J., 363.
Carlson, F. A., 117.
Carney, M., 597.
Carpenter, E. J., 316.
Carpenter, P. H., 416.
Carpenter, T. M., 370.
Carr, R. H., 327, 407.
Carré, H., 80, 182, 282.
Carrero, J. O., 754.
Carrier, L., 191, 635.
Carroll, D. C., 806.
Carroll, W. E., 872.
Carruthers, J. H., 93.
Carson, E., 718.
Carter, D. G., 590.
Carter, L. M., 116.
Carter, R. H., 309.
Carter, W. T., jr., 416, 616.
Carvalhoz, B., 392.
Carver, G. W., 496.
Caryl, R. E., 742.
Case, L. N., 378.
Casella, D., 140.
Caslick, E. A., 178, 284.
Cassidy, T. P., 558.
Castellani, A., 112.
Castillo, J. M., del, 217.
Castle, W. E., 66, 366, 568.
Castro Biedma, P., 171.
Cathcart, C. S., 233, 325, 422.
Cathcart, E. P., 257.
Catlin, C. N., 317.
Cattermull, C. C., 692.
Cauchemez, L., 182.
Caverhill, P. Z., 838.
Cecil, R. L., 880.
Ceni, C., 164.
Cerighelli, R., 216.
Césari, E., 505.
Chaffin, J., 354.
Challis, E. O., 474.
Chamberlin, R. V., 652.
Chambers, T. G., 891.
Chandler, A. C., 657.
Chandler, S. C., 156.
Chandler, W. H., 98, 107, 637.
Chapman, A., 847.
Chapman, G. H., 48, 299, 633, 647.
Chapman, H. H., 238.
Chapman, L. M., 784.

Chapman, R. N., 854, 855.
Charbonnier, I., 84, 85.
Chardón, C. E., 52, 544.
Charles, T. B., 498.
Charters, W. W., 492, 596.
Chase, E. P., 800.
Chase, L. W., 792.
Chassant, M., 615.
Chataway, T. D., 737.
Chaveau, A., 278.
Cheekmur, F., 462.
Chen, T. C., 369.
Chenoweth, W. W., 297.
Chesnutt, S. L., 194.
Chilcott, E. C., 135, 418.
Chilson, C. H., 700.
Chipp, T. F., 652.
Chittenden, A. K., 84.
Chittenden, F. H., 454.
Christensen, A., 34.
Christensen, F. W., 869.
Christensen, H. R., 118, 804, 813.
Christensen, J. J., 747.
Christiansen, M., 181, 381.
Christiansen - Weniger, F., 812.
Christie, G. I., 492, 596, 599, 711, 799, 899.
Christie, J. R., 357.
Christie, W. W., 388.
Christoph, H., 424.
Christopher, W. N., 747.
Christou, 666.
Chun, W. Y., 745.
Church, A. H., 143.
Church, L. M., 185.
Church, M. B., 311.
Cipra, A., 15.
Clark, A. J., 259.
Clark, C. F., 332.
Clark, F. E., 483.
Clark, J. A., 37, 335, 634. 734, 832, 890.
Clark, J. H., 98, 197, 396.
Clark, M., 59.
Clark, M. B., 727.
Clark, N. A., 856.
Clark, T., 257, 700.
Clarke, A., 114.
Clarke, G., 322.
Clarke, H. W., 592, 593.
Clarke, I. D., 717.
Clarke, W. T., 90.
Clarté, R., 615.
Clausen, C. P., 355.
Clausen, R. E., 368.
Clawson, A. B., 583.
Clayton, C. H. J., 886.
Clayton, W., 109.
Clemens, W. A., 848.
Clement, C. E., 277, 377, 699.
Clement, F., 885.
Clements, F. E., 28, 29, 30.
Cleveland, C. R., 853.
Clevenger, C. B., 616.
Clinton, G. P., 534, 742.
Clinton, L. A., 492.
Clough, R. W., 802.
Clyde, A. W., 890.
Coad, B. R., 299, 558, 590, 659.
Coats, R. H., 491.
Cobb, F. E., 141.
Cobb, N. A., 357.
Cobb, W. B., 616.
Coe, M. R., 309.
Coffey, W. C., 800.
Coffin, M., 98.
Coit, J. E., 846, 847.
Colby, A. S., 41.
Colby, G. E., 121, 124, 727.
Cole, H. S., 718.
Cole, J. S., 134.
Cole, L. J., 171, 463, 676.
Coleman, C. T., 386.
Coleman, F. H., 718.
Coleman, G. E., 861, 862.
Coleman, T. A., 596.
Colin, H., 822.
Collatz, F. A., 12.
Collazo, J. A., 565.
Colle, 133, 134.
Collinge, W. E., 251.
Collins, S. D., 257.
Collins, S. H., 65.
Collins, W. D., 587.
Collins, W. O., 116.
Collison, R. C., 534.
Colman, H. N., 579.
Colquette, R. D., 176.
Comber, N. M., 407.
Combs, S., 780.
Compere, H., 496.
Conacher, H. M., 891.
Conley, E., 798.
Conn, H. J., 625, 731.
Conn, H. W., 625.
Connaway, J. W., 79.
Conner, S. D., 616, 636.
Connor, L. G., 795.
Connor, M. E., 853.
Connors, C. H., 438.
Consoliver, E. L., 85.
Cook, F. C., 247, 356, 400, 448.
Cook, H. A., 505.
Cook, H. W., 198.
Cook, M. T., 498.
Cook, O. F., 432.
Cook, R. B., 474.
Cook, W. C., 758.
Cooke, G. K., 700.
Cooke, M. T., 151, 652.
Cooley, R. A., 152, 251, 450.
Coolidge, C., 602.
Coombs, J. A., 886.
Coons, G. H., 443, 446, 841.
Cooper, H. R., 416.
Cooper, T., 272, 599.
Cooper, W. S., 822.
Corbett, G. H., 255, 658, 855.
Corkins, C. L., 51.
Corley, R. C., 662.
Cormany, C. E., 97.
Cornell, F. D., 199.
Cornman, C. T., 99.
Corper, H. J., 380.
Corpus, R., 193.
Corry, W. M., 231.
Corvez, A., 376.
Cory, E. N., 354.
Cosnier, H., 595.
Costantin, J., 822.
Cotton, A. D., 645, 752.
Cotton, R. T., 256.
Cottringer, P., 385.
Coulter, M. C., 24.
Coulthard, H. L., 883.
Cousins, C. W., 193.
Coventry, B. O., 537.
Cowan, D. R., 397.
Coward, H. F., 132.
Coward, K. H., 259, 260, 767, 768, 780.
Cowart, R., 32.
Cowdry, E. V., 252.
Cox, H. A., 42.
Cox, H. J., 314.
Cox, J. F., 31, 97, 495.
Craig, J. A., 498.
Craighead, E. M., 852.
Craighead, F. C., 154, 448, 452.
Crain, L. D., 596.
Cram, E. B., 684.
Cramer, W., 61.
Crandall, C. S., 139.
Crane, M. B., 234.
Crasemann, E., 206.
Craster, C. V., 559.
Crawford, H. G., 155, 848.
Crawford, R. F., 197.
Crawshaw, F. D., 284.
Crepin, C., 529.
Crew, F. A. E., 463.
Crewshaw, J. E., 83.
Criddle, N., 848.
Crider, F. J., 641.
Crist, J. W., 29, 30, 799.
Critz, H., 299.
Crocheron, B. H., 492, 799.
Crocker, W., 28.
Croft, V., 98.
Cromer, C. O., 830.
Crosby, D. J., 596.
Crosley, W., 384.
Cross, F., 283.
Cross, F. B., 138.
Cross, H. E., 156, 157, 158.
Crowdle, J. H., 661.
Crowell, B. C., 180.
Crowley, D. J., 199.
Crowther, C., 68.
Cruess, W. V., 412, 496.
Crump, E. S., 886.
Cubberley, E. P., 296.
Cuénot, L., 567.
Culbertson, C. C., 571, 572, 870, 871.
Cumings, G. A., 86, 87.
Cummins, A. B., 318.

Cunningham, E., 184.
Curasson, G., 884.
Curie, I., 217.
Curie, I. H., 198.
Curler, B. F., 99.
Curot, E., 772, 782.
Curran, C. H., 848.
Curran, G. C., 747.
Currier, E. L., 188.
Curry, A. S., 197.
Curtis, D. H., 377.
Curtis, M. E., 157.
Curtis, R. S., 772, 773, 780, 787.
Curtis, W. L., 157.
Curtiss, C. F., 4, 798.
Cushing, E. R., 178.
Cushman, C. G., 375
Cushman, H. E., 674.
Cutler, G. H., 46, 47.
Cutter, A. B., 687.
Czapek, F., 218.

Daane, A., 542.
Dack, G. M., 881.
Daggett, W. L., 203.
Dahlberg, A. C., 380.
Dahle, C. D., 75.
Dakan, E. L., 698.
D'Albuquerque, J. P., 133.
Dalla Torre, G., 176.
Dallimore, W. H., 837.
Dalling, T., 682.
Dallyn, F. A., 216.
Dalrymple, W. H., 271, 881.
Dalrymple-Hay, R., 342.
Dam, W. van, 74, 376.
Damianovich, H., 565.
Dana, B. F., 445.
Danforth, C. H., 567.
Daniel, A., 894.
Danila, P., 110.
Darby, W. D., 528.
Darlow, A. E., 467.
Daubney, R., 787.
Dautrebande, J., 688.
Davenport, C. B., 24, 567.
Davenport, E., 395, 707.
Davey, E. J., 171.
Davidson, J. (England), 153.
Davidson, J. (U. S. D. A.), 213.
Davidson, J. B., 572.
Davies, A. E., 389.
Davies, R. E., 470.
Davis, A. H., 187.
Davis, D. J., 460.
Davis, E. J., 231.
Davis, H. P., 875.
Davis, J. J., 51, 153, 242.
Davis, M. B., 236.
Davis, N. C., 667.
Davis, R. J., 199.
Davis, R. L., 332.
Davis, R. O. E., 316.
Dawson, R. W., 397.
Day, V. S., 288.
Deam, C. C., 341.
Dean, G. A., 251, 397, 657.
De Baufre, W. L., 84.
DeBaun, R. W., 197.
De Bruyn, H. L. G., 242.
Dechambre, E., 165.
Decker, S. S., 498.
de Gusmão, A. C. A., 392.
de Haan, Van B., 246.
Deighton, T., 317.
de Keghel, M., 83.
Delamare, N., 91.
del Castillo, J. M., 217.
Delos, A., 895.
Delwiche, E. J., 629.
Demandt, E., 50.
de Mattos Filho, B., 413.
Demerec, M., 632.
de Mol, W. E., 822.
Demolon, A., 123, 215, 513.
Demontès, V., 208, 295.
Denaiffe, 133, 134.
Denham, H. J., 528, 646.
Denier, P., 30.
Denison, F. N., 15, 615.
Denton, M. C., 114, 492.
Desch, C. H., 308.
de Seabra, A. L. G., 93.
Dessaisaix, R., 85.
De Turk, E. E., 616.
de Verteuil, J., 827.
Deyoe, A. M., 415.
DeYoung, W., 720.
Dickey, G. D., 202.
Dickinson, F., 202.
Dickinson, H. C., 887.
Dickson, B. T., 442.
Dickson, E. C., 859.
Dickson, J. G., 345, 644.
Dieckmann, T., 214.
Dietel, P., 145.
Dikmans, G., 283.
Dill, D. B., 122.
di Mattei, P., 663.
Dimock, W. W., 272.
Dingler, M., 50.
Disselhorst, R., 177.
Dixon, H. H., 519.
Doan, F. J., 805.
Dobrodeev, A. I., 356, 454.
Dodd, D. R., 96.
Dodd, S., 178.
Dodds, E. C., 560.
Dodge, B. O., 348, 846.
Dodson, W. R., 737, 898.
Doelle, J. A., 422, 879.
Doerner, A. M., 97, 199.
Doidge, E. M., 149.
Doisy, E. A., 858.
Dokken, I., 89.
Domínguez, F. A. L., 25.
Donadoni, M., 36.
Donnan, F. G., 308.
Doolittle, S. P., 644, 646.
Door, C., 899.
Doran, W. L., 345, 349, 350.
Dorph-Petersen, K., 232.
Doten, S. B., 696, 709.
Dotterrer, W. D., 696, 700.
Doucette, C. F., 658.
Dougherty, J. E., 273.
Douglass, A. E., 30.
Dow, J., 664.
Dowell, A. A., 670.
Dowell, C. T., 495, 600.
Down, E. E., 35.
Downes, W., 848.
Downs, P. A., 398.
Dowson, W. J., 250.
Doyer, L., 840.
Doyer, L. C., 443.
Doyle, T. M., 179.
Dozier, C. C., 863.
Drake, C. J., 853.
Drechsler, C., 747.
Drew, A. H., 61.
Drieberg, C., 255.
Drummond, J. C., 59, 608, 780.
Dubovsky, B. J., 860, 861, 862, 863.
Ducellier, L., 736.
Duckett, A. B., 456.
Ducomet, V., 529.
Dudley, H. W., 803.
Dudley, J. E., jr., 653, 760, 854.
Duffee, F. W., 687, 688.
Dufourt, A., 769.
Duggar, J. F., 492.
Duncan, J. R., 97, 432.
Dungan, G. H., 343, 541, 841.
Dunham, E. D., 756.
Dunn, L. C., 274, 575, 776.
Dunn, L. H., 157, 254.
Dunn, R., 571.
Dunnewald, T. J., 719.
du Noüy, P. L., 110.
Dunshee, C. F., 34.
Dunstan, A. E., 308.
Durant, F. R., 293.
Durham, G. B., 822.
Durland, W. D., 440.
Duruz, W. P., 53.
Dusserre, C., 511.
Dutcher, R. A., 605.
du Toit, H. S., 192.
d'Utra, G. R. P., 36.
Dutruel, E., 292.
Dyckerhoff, 252.
Dyer, B., 203.

Earle, F. S., 35.
Eason, C. M., 889.
East, E. M., 25, 568.
Easterby, H. T., 828.
Eastham, J. W., 44, 150.
Eastman, M. G., 328.
Eaton, H. F., 499.
Eaton, S. V., 420.
Eaton, T. H., 492, 493.
Eckberg, C. A., 498.
Eckles, C. H., 473.
Eckman, R. S., 361.
Eckstein, F., 50, 255.
Eddy, C. W., 277.

Eddy, W. H., 361, 663.
Edgar, G., 612.
Edgington, B. H., 198.
Edmondson, R. B., 163, 567.
Edser, E., 308.
Edwardes, T., 660.
Edwards, A. C., 14.
Edwards, C. W., 464, 471, 480, 494.
Edwards, H., 703, 706, 800.
Edwards, W. E. J., 97, 469.
Eeckhout, A. V., 716.
Efflatoun, H. C., 53.
Ehrenberg, P., 414.
Ehrensberger, E., 69.
Ehrlich, 881.
Eide, E., 744.
Einset, O., 197.
Eldredge, I. F., 655.
Eley, C., 836.
Elford, F. C., 69.
Elgar, W. R., 37.
Eliot, H. M., 489.
Ellenberger, H. B., 475.
Ellerman, V., 81.
Ellinger, T., 474.
Ellington, E. V., 275.
Elliot, W., 65.
Elliott, B. G., 85.
Elliott, G. R. B., 686, 790.
Elliott, J. A., 98, 246.
Ellis,C., 207.
Ellsworth, C. E., 383.
Elsdon, G. D., 505.
Elwood, P. H., 697.
Ely, F., 164, 778.
Embleton, H., 697.
Embrey, H., 563.
Emerson, F. C., 483.
Emerson, R. A., 632.
Emmett, A. D., 159.
Engels, O., 818.
England, C. W., 805.
England, E. H., 611.
Englund, E., 489.
Ensign, N. E., 284.
Erdman, L. W., 697, 726.
Eredia, F., 509.
Erf, O., 605.
Eriksson, J., 651.
Eshleman, C. H., 718.
Estabrook, L. M., 90, 492.
Esty, J. R., 162, 863.
Etheridge, W. C., 228.
Eugster, G., 370.
Evans, A. C., 380.
Evans, A. T., 635.
Evans, C. R., 522.
Evans, D., 389.
Evans, E. A., 277.
Evans, F. L., 277.
Evans, G., 734.
Evans, H. M., 605.
Evans, I. B. P., 249.
Evenson, O. L., 277.
Evers, N., 611.
Évrard, F., 894.
Evvard, J. M., 373, 571, 572 870, 871.
Ewing, A., 889.
Ewing, H. E., 455.
Eynon, L., 310, 608, 715.

Faber, H. K., 856.
Fabre, J.-H., 251.
Faes, H., 222, 655.
Fagan, M. M., 256.
Fahringer, J., 50.
Fairbanks, J. L., 498.
Fairfield, W. H., 734, 832.
Fairhall, L. T., 113.
Fairley, N. H., 77.
Fales, H. L., 457.
Falk, K. G., 109.
Fargo, J. M., 672.
Farley, A. J., 138, 235, 349.
Farmer, J. B., 95.
Farneti, R., 844.
Farrell, F. D., 495.
Farrell, G. E., 394.
Fauchère, A., 440.
Faulkner, O. T., 31, 734, 823.
Fawcett, H. S., 540, 649, 650, 846, 847.
Fay, C. R., 91.
Fearon, W. R., 11.
Fedde, M. S., 596.
Feigl, F., 407.
Feilitzen, H. von, 22, 527.
Feld, J., 484.
Fell, H. B., 463.
Felt, E. P., 152.
Fenton, E. W., 177.
Fenton, F. A., 654, 853.
Fergus, E. N., 131.
Ferguson, J. G., 818.
Ferguson, O. J., 492.
Ferraz, J. de S., 207.
Ferraz, S., 314.
Ferrière, C., 448.
Ferris, E. B., 330, 428.
Ferris, G. F., 252, 652.
Ferris, L. W., 13.
Fiebiger, J., 377.
Fiedler, A. C., 620.
Fielding, C., 389.
Fields, J. N., 805.
Fiess, U., 92.
Fife, R., 195.
Figgis, D., 374.
Filho, B., de M., 413.
Filley, H. C., 292.
Fincher, M. G., 178.
Findlay, G. M., 461.
Findlay, L., 65.
Fingerling, G., 569.
Finks, A. J., 258, 865.
Fischer, G., 85, 486.
Fischer, H., 522.
Fish, J. C. L., 483.
Fishenden, M., W., 289.
Fisher, D. F., 49, 445.
Fisher, N. F., 463.
Fisher, R. A., 314, 567, 576.
Fishwick, V. C., 780.
Fisk, W. W., 475.
Fiske, G. B., 489, 793.
Fiske, J. G., 635.
Fitch, A., 355.
Fitch, C. P., 478.
Fite, A. B., 154.
Fitting, H., 125.
Fitzpatrick, T. J., 28.
Flanigan, G. E., 277.
Flatt, C. A., 374.
Flebut, A. J., 154.
Fleischer, M., 616.
Fleischmann, R., 228.
Fleming, C. E., 582, 583.
Fleming, R. S., 455.
Fletcher, T. B., 849.
Flint, E. R., 897, 898.
Flint, W. P., 330, 355, 431, 450, 452.
Flora, S. D., 207.
Florell, V. H., 825.
Floyd, M. M., 299.
Flu, P. C., 587, 591.
Fluhrer, K., 19, 23.
Fluke, C. L., 653.
Fogle, F. E., 889.
Follansbee, R., 587.
Folsom, D., 247.
Foote, J. M., 896.
Forbes, A. C., 743.
Forbes, E. B., 72, 605.
Forbes, S. A., 151.
Forbes, W. T. M., 652.
Ford, K. L., 700.
Forel, A., 453.
Fortún, G. M., 334.
Foster, D. L., 11.
Foster, H. J., 611.
Foster, L., 868.
Foster, W. A., 572, 697.
Fouassier, M., 175.
Fouts, R., 157.
Fowle, F. F., 483.
Fowler, F. H., 383.
Fowler, W. C., 698.
Fox, H. D., 398.
Fox, H. M., 115.
Fox, J. J., 90.
Fracker, S. B., 357.
Francis, E., 784.
Frank, A., 97, 395, 599, 845, 850.
Frank, L., 410.
Frank, L. C., 700.
Franklin, H. J., 237.
Fraps, G. S., 320.
Fraser, M., 95, 392.
Fraser, W. J., 875.
Frazier, W. C., 660, 679.
Fred, E. B., 35, 201, 620, 626, 669, 819.
Frederich, W. J., 846.
Frederick, R. C., 285.
Freeborn, S. B., 684.
Freeland, E. C., 114.
Freeman, G. F., 99.

Freeman, J. F., 397.
Fréjacques, M., 517.
Frerichs, E. A., 292.
Frets, G. P., 770.
Frevert, H. W., 387.
Frey, J. J., 700.
Frey, R. W., 717.
Friday, D., 290.
Friedrich, A., 503.
Friedrichs, K., 50, 255.
Friend, R. B., 899.
Fries, J. A., 864.
Frisbie, W. S., 700.
Froehlich, P., 489.
Froggatt, W. W., 451, 758.
Fröhner, E., 684.
Frölich, G., 165.
Fromme, F. D., 545.
Fronda, F. M., 369.
Frost, J. N., 178.
Frost, S. W., 656, 855.
Frost, W. D., 677.
Fruwirth, C., 132, 735.
Fry, W. H., 722.
Fryer, J. C. F., 152, 255.
Fryer, P. J., 540.
Frysinger, G. E., 596.
Fuertes, L. A., 373.
Fujiwhara, S., 615.
Fukushi, T., 548.
Fullaway, D. T., 448.
Fuller, G. D., 439.
Fuller, J. G., 669, 672.
Fuller, J. W., 178, 183.
Fuller, W. D., 718.
Fulmer, E. I., 819.
Fulton, B. B., 850.
Fultz, F. M., 837.
Funchess, M. J., 725.
Fürth, O., 158.
Futamura, H., 79, 785.
Fyfer, (Mrs.) J. K., 297.
Fyson, P. F., 127.

Gabrielson, I. N., 756.
Gadd, C. H., 342.
Gadd, W. L., 484.
Gaessler, W. G., 779.
Gahan, A. B., 56, 256.
Gaiger, S. H., 682.
Gaines, E. F., 244.
Gaines, R. C., 156.
Gaines, W. L., 877.
Gainey, P. L., 515, 619, 722, 813.
Galbraith, D., 65.
Gallagher, B. A., 885.
Gallagher, H. T., 487.
Gallagher, P. H., 309.
Galpin, C. J., 492.
Gandrup, J., 626.
Gangolli, D. M., 609.
Gannon, A. F., 287.
Garcia, F., 599.
Gardner, C. A., 837.
Gardner, E., 203.
Gardner, M. W., 51, 144, 246, 754.
Gardner, V. R., 640.
Gardner, W., 16.
Garman, P., 556.
Garner, W. E., 308.
Garner, W. W., 326, 334.
Gerrad, G. H., 831.
Garratt, G. A., 744.
Garrett, C. C., 508, 509.
Garrison, H. S., 431.
Gärtner, R., 164.
Gasser, G. W., 426, 434, 491.
Gasthuys, P., 590.
Gates, F. H., 155, 452.
Gates, R. R., 567.
Gaub, J., 275.
Gauhn, E. R., 699.
Gäumann, E., 149.
Gaumnitz, E. W., 488.
Gay, C. W., 66.
Gearhart, C. R., 198.
Geddes, A. E. M., 115.
Geiger, J. C., 859.
Geiger, W., 787.
Geilmann, W., 123, 414, 419.
Geise, F. W., 233, 347.
Gemmerling, W. W., 212.
George, D. C., 453.
George, E., 180.
Georgeson, C. C., 426, 434, 494.
Gerdes, R., 85.
Gere, C. M., 100, 498, 679.
Gericke, M. L., 491, 596.
Gericke, W. F., 132, 519, 530, 628.
Gerry, E., 238.
Gersdorff, C. E. F., 714.
Gery, 31.
Getman, A. K., 493, 895.
Ghesquière, J., 759.
Ghosh, M., 725.
Gibbs, W. E., 308.
Giberne, A., 836.
Gibson, A. J., 240.
Gibson, H. V., 858.
Giesecke, F., 123.
Giesecke, F. E., 284, 685.
Gilchrist, D. A., 214.
Gillette, C. P., 450, 494.
Gillette, H. P., 184.
Gillis, M. C., 137.
Gilman, H. L., 178.
Giltner, L. T., 163, 567.
Giltner, W., 99.
Gimingham, C. T., 309.
Giovine, D., 284.
Girard, A., 895.
Girola, C. D., 843.
Gladson, W. N., 492.
Glasgow, H., 39, 49, 53, 97.
Glassett, F. S., 900.
Glenn, P. A., 54.
Glenny, A. T., 262, 478.
Glick, P. A., 251, 452.
Godfrey, G. H., 345.
Godlewski, E., 816.
Goerttler, V., 680.
Goldberg, S. A., 178.
Goldblatt, H., 61.
Golding, J., 203, 265, 780.
Goldschmidt, H., 72.
Goldschmidt, R., 668.
Goldsmith, G. W., 29.
Goliński, S., 755.
Gonzales, B. M., 667.
Gonzalez, L. G., 835.
Good, E. S., 273.
Goodell, C. J., 267, 600, 869.
Gooderham, C. B., 357, 855.
Goodey, T., 179, 499.
Goodman, A. M., 483.
Goodwin, O. T., 196.
Goodyear, T. S., 142.
Gorbatchev, P. P., 718, 719.
Gordon, A. K., 182.
Gordon, J. H., 718.
Gordon, J. K., 479.
Gordon, N. E., 17.
Gore, H. C., 506.
Gore, H. M., 499.
Gorham, R. P., 50.
Gorjatschkin, W., 86.
Gortner, R. A., 11, 26, 203.
Goss, R. W., 46, 147.
Gossard, H. A., 656.
Gotta, H., 562.
Gottfried, A., 611.
Gough, L. H., 660.
Gourley, J. H., 340.
Govan, J., 186.
Gow, J. P., 75.
Gowen, J. W., 174, 677, 877.
Gowen, M. S., 174.
Grabau, A. W., 510.
Graber, L. F., 31, 130, 630.
Graftiau, J., 816.
Graham, R., 382, 481, 684.
Graham, S. A., 254.
Granström, K. O., 110.
Grantham, G. M., 19.
Grapp, G. H., 277.
Gratz, L. O., 600.
Graul, E. J., 620.
Graves, H. S., 299.
Gray, D. S., 616, 719.
Gray, D. T., 69, 697, 707.
Gray, G. F., 396.
Gray, J., 600.
Gray, L. C., 290.
Greaves, J. E., 321.
Greeley, W. B., 341.
Green, A. W., 240.
Green, E. L., 199.
Green, T. C., 498.
Green, W. J., 494.
Greenaway, A. J., 608.
Greene, L., 754.
Greene, S. H., 277.
Greene, S. W., 465.
Greenish, H. G., 12.
Gregg, W. R., 508.
Griffin, E. L., 456.
Griffith, J. P., 341, 555.

Griffiths, E., 187.
Grimes, W. E., 487.
Grimmer, W., 802.
Grist, D. H., 529.
Groebbels, F., 64.
Groenewege, J., 151.
Groh, H., 825.
Gronover, 612.
Gross, A. O., 151.
Grosser, 252.
Grossfeld, J., 204.
Grotlisch, V. E., 143.
Guberlet, J. E., 586.
Guerra de Seabra, A. L., 93.
Guerrant, N. B., 497.
Guerrero, J., 414, 426, 435.
Guiart, J., 76.
Guibier, H., 42.
Guillebaud, W. H., 837.
Guillin, R., 23.
Guillochon, L., 31.
Gullickson, T. W., 473.
Gunnels, C. E., 492.
Gusmão, A. C. A. de, 392.
Gyaw, M. B., 586.

Haag, J. R., 498.
Haan, Van B. de, 246.
Haas, A. R. C., 516, 628, 729, 730.
Haberlandt, G., 219.
Hackedorn, H., 268.
Hackleman, J. C., 330.
Hadfield, W. A., 156.
Hadley, C. H., 454, 853, 854.
Hadley, F. B., 675, 681, 684.
Haglund, E., 74.
Hahn, A., 613, 560.
Hahn, C. S., 426, 434.
Haigh, L. D., 23.
Halama, M., 329.
Halbersleben, D. L., 373.
Hall, A. D., 393, 807.
Hall, C. J. J. van, 144.
Hall, F. G., 504.
Hall, H. B., 91, 198.
Hall, H. F., 576.
Hall, H. M., 29.
Hall, I. C., 667, 880.
Hall, J. A., 848.
Hall, M. C., 76, 182, 183, 482, 684, 786.
Hall, S. A., 878.
Hall, T., 879.
Hall, T. R., 199, 697, 845.
Hall, W. T., 452.
Hallenbeck, C., 207, 718.
Hallett, H. S., 475.
Halliburton, W. D., 358.
Halpin, J. G., 672.
Halverson, J. O., 66.
Hamblin, C. O., 541, 546, 547.
Hamblin, S. F., 439.
Hamilton, G. M., 132.
Hamilton, H. G., 600.
Hamilton, S. N., 65.
Hammer, B. W., 376.
Hammond, G. H., 848.
Hammond, J., 270, 781, 875.
Hammond, R. L., 878.
Hammond, W. E., 871.
Hanawalt, F. A., 50.
Handschin, W. F., 492.
Haner, R. C., 610.
Haney, L. H., 392.
Hanger, W. E., 798.
Hannerz, E., 73.
Hansen, A. A., 584.
Hansen, D., 129, 170, 824, 898.
Hansen, J., 679.
Hansen, N. E., 533.
Hansen, T. S., 439.
Hanson, C. H., 596.
Hanson, H. C., 558.
Hansson, N., 67, 166.
Haramaki, K., 564.
Harcourt, R., 616, 660.
Harden, A., 410.
Harden, T. D., 900.
Hardenberg, C. B., 848.
Hardenburg, E. V., 332.
Harder, R., 127.
Harding, H. A., 698, 700.
Harding, L., 312.
Hardy, W. B., 308.
Harkin, J. B., 838.
Harlan, H. V., 219.
Harlan, J. D., 534.
Harler, C. R., 15.
Harman, S. W., 552.
Harmer, P. M., 19.
Harned, R. W., 454.
Harper, B., 96.
Harper, H. J., 622, 697.
Harper, R. M., 92.
Harrington, F. M., 129, 136.
Harrington, G. T., 27, 28, 221.
Harrington, J., 185.
Harrington, J. B., 840.
Harris, A. E., 800.
Harris, F. S., 317, 620.
Harris, J. A., 26, 273, 776.
Harris, L. J., 501.
Harrison, W. H., 119, 120.
Harshaw, H. M., 196.
Hart, E. B., 72, 73, 167, 672.
Hart, G., 218.
Hart, G. H., 79.
Hart, R., 253.
Härtel, F., 204.
Harter, L. L., 540, 729, 754.
Hartley, E. A., 855.
Hartley, G. I., 151.
Hartman, H., 742.
Hartman, L. M., 797.
Hartman, R. E., 444.
Hartman, S. C., 298.
Hartwell, B. L., 599, 800.
Hartwell, F. E., 208.
Hartzell, A., 758.
Hartzell, F. Z., 52, 152.
Haselhoff, E., 19, 21, 23.
Haseman, L., 253, 656.
Haskell, S. B., 510, 596.
Hastings, A. B., 806.
Hastings, E. G., 679.
Hastings, J. C., 607.
Hastings, W. G., 42.
Hatch, K. L., 800.
Hatfield, W. D., 202.
Hatt, W. K., 184.
Hatton, R. G., 37.
Hauduroy, P., 177.
Hauge, S. M., 899.
Haughs, D., 143.
Haun, F., 23.
Hauser, W., 66.
Hausman, L. A., 412.
Hausmann, E., 286.
Havas, G., 228.
Hawes, A. F., 239.
Hawkins, R. S., 620.
Hawley, I. M., 198, 848.
Hawley, R. C., 238.
Hay, R. D.–, 342.
Hayden, C. C., 676.
Hayden, P. A., 273.
Hayes, A. W., 393.
Hayes, F. A., 416.
Hayes, F. M., 79.
Hayes, H. K., 134, 200, 841.
Hayne, T. B., 55.
Hays, F. A., 466, 467, 470, 873.
Headden, W. P., 513.
Headlee, T. J., 138, 355.
Headley, F. B., 621, 630, 636, 696.
Heald, F. D., 241, 445.
Healy, D. J., 273.
Heaton, T. B., 261.
Hebard, M., 652.
Hector, G. P., 734.
Hedrick, U. P., 103, 107, 338, 340, 535.
Heen, C., 277.
Heerden, W. S. van, 168.
Heidelberger, M., 501.
Heilbron, I. M., 820.
Heinicke, A. J., 28, 235.
Heinrich, C., 254, 760.
Helbronner, A., 18.
Heller, V. G., 562.
Helm, C. A., 228.
Helmer, R. H., 734.
Helser, M. D., 570.
Helwig, C., 686.
Henderson, G. C., 292.
Henderson, G. S., 85.
Hendrickson, A. H., 40.
Henke, L. A., 168.
Henning, J. C., 197.
Henningsen, C., 311.
Henriques, O. M., 309.
Henry, A., 837.
Henry, A. J., 207, 509, 718.
Henry, A. W., 196, 747.
Henry, M., 178.
Henry, Y., 82.
Hensel, R. L., 224.
Henslow, T. G. W., 439.

Hepler, J. R., 234.
Hepner, F. E., 413.
Heppner, M. J., 637.
Herbert, P. A., 43, 439.
Hermann, P., 762.
Herrick, G. W., 355.
Herschel, W. H., 387.
Hervey, G. W., 576, 794.
Herzog, L., 400.
Hess, A. F., 58, 65, 365.
Hesse, A. J., 499.
Hesselbach, K., 680.
Hesselink, E., 142.
Hetsch, H., 177.
Hetzel, R. D., 800.
Heuser, G. F., 200.
Hibbard, B. H., 91, 690, 705.
Hibbard, P. L., 34.
Hicks, W., 71.
Hicks, W. H., 734, 832.
Higgins, B. B., 346.
Hilditch, T. P., 308.
Hildreth, A. C., 496.
Hiley, W. E., 837.
Hill, A. R., 704.
Hill, C. E., 223, 245.
Hill, E. B., 97, 495, 898.
Hill, J. A., 495.
Hillman, V. R., 698.
Hills, J. L., 4, 675, 799.
Hilson, G. R., 228.
Hiltner, L., 400.
Hinshaw, W. R., 698.
Hirata, K., 895.
Hisaw, F. L., 250.
Hiscock, I. V., 699.
Hite, B. C., 27.
Hitier, H., 296.
Hitier, J., 296.
Hoagland, D. R., 98.
Hoagland, R., 63.
Hoare, A. H., 153.
Hoare, C. A., 182.
Hobbs, G. W., 85.
Hobbs, H. E., 718.
Hobson, G., 249.
Hockey, J. F., 243.
Hodges, J. A., 98, 698.
Hodgson, E. R., 900.
Hodgson, R. W., 641.
Hoeft, G. L., 98.
Hoehne, F. C., 34.
Hoffer, G. N., 327.
Hoffman, A. H., 287, 688.
Hoffman, J. D., 890.
Hoffman, J. V., 238.
Hoffman, W. F., 203.
Hofman-Bang, N. O., 170.
Hofmeister, F., 562.
Hogue, M. J., 476.
Holbert, J. C., 697.
Holbert, J. R., 243.
Holden, E. D., 630, 643.
Holden, J. A., 34, 328, 670.
Holder, R. C., 674.
Holland, E. B., 678.
Hollingsworth, J. B., 699, 700.
Holloway, T. E., 848.
Holman, 581.
Holman, H. P., 386.
Holmes, A. D., 461.
Holmes, C. L., 196, 793.
Holmes, H. N., 109.
Holt, L. E., 457.
Holtz, H. F., 211.
Honcamp, F., 669.
Honegger, P., 275.
Hood, E. G., 500.
Hooper, J. J., 780.
Hoover, H., 603.
Hoover, J. M., 494.
Hopkins, A. D., 452.
Hopkins, A. W., 708.
Hopkins, B. E., 478.
Hopkins, E. F., 821.
Hopping, A., 806.
Horlacher, W. R., 397, 698.
Horne, W. T., 650.
Horton, P. M., 506.
Horton, R. E., 718, 719.
Hortvet, J., 275.
Hostetler, E. H., 69, 470, 775.
Houben, J., 110.
Houdremont, E., 214.
Hough, W. S., 353.
Houghland, G. V. C., 98, 396.
Houlbert, C., 761.
Houser, J. S., 654.
Houston, A. C., 285.
Houtz, R. L., 879.
Howard, A., 231, 815.
Howard, G. L. C., 231, 815.
Howard, J. R., 596.
Howard, L. O., 398.
Howard, R. F., 340.
Howard, S. H., 141.
Howard, S. T., 590.
Howard, W. J., 67.
Howe, G. H., 339.
Howe, L., 567.
Howell, J. P., 491.
Howell, S. P., 83.
Howitt, J. E., 825.
Hoxie, J. L., 374.
Hubback, J., 32, 529.
Huber, L. L., 198.
Hucker, G. J., 731.
Huddleson, I. F., 478, 879, 884.
Hudson, H. F., 848.
Huff, W. J., 590.
Hughes, C. E., 603.
Hughes, H. D., 230.
Hulbert, H. W., 230.
Hulce, R. S., 874.
Hulst, J. H. Ver, 201.
Hulton, H. F. E., 31.
Hultz, F. S., 867, 890.
Hume, A. N., 527, 635.
Hume, E. M., 60.
Humphrey, G. C., 675, 874.
Humphreys, W. J., 508, 718.
Hungerford, C. W., 748.
Hungerford, De F., 189.
Hungerford, J. D., 868.
Hunt, A. L., 373.
Hunt, C. H., 259, 675.
Hunt, C. L., 158.
Hunt, C. M., 759.
Hunt, H. R., 899.
Hunt, R. E., 865, 900.
Hunt, T. F., 1, 98.
Hunter, B., 88.
Hunter, O. W., 213, 364, 626.
Hunter, S. J., 251.
Hunter, W. D., 659.
Hunter, W. T., 149.
Hupbauer, A., 482.
Hurd, A. M., 245.
Hurst, C. B., 696.
Hurst, C. C., 567.
Hurt, R. H., 300.
Husain, M. N., 322.
Hutchings, C. B., 848.
Hutchinson, C. M., 117, 120, 210.
Hutchison, C. B., 32.
Hutchison, H. S., 65.
Hutchison, R., 65.
Hutson, J. C., 450, 453, 455, 849.
Hutt, W. N., 337.
Hutton, R. E., 872.
Huxley, J. S., 266.
Hyatt, P., 252.
Hyde, J. H., 887.
Hyslop, G. R., 133.
Hyslop, J. A., 352.

Ibsen, H. L., 864.
Iddings, E. J., 298, 798.
Ihle, J. E. W., 256.
Illick, J. S., 42.
Imai, Y., 528.
Inouye, T., 181.
Irish, J. H., 206, 412.
Irvine, H. D., 191.
Irving, R. E., 198.
Isaachsen, H., 605, 607.
Israël, 380.
Israelsen, O. W., 198.
Issatschenko, B., 731.
Ivey, J. E., 373.
Iwanow, E., 683.

Jackson, H. S., 145.
Jacobson, E. L., 794.
Jaegar, F., 204.
James, J. H., 387.
Jameson, A. P., 154.
Jamison, U. S., 408.
Janeway, R., 387.
Janini, R. J., 438.
Jännes, J., 166.
Janssen, G., 635.
Jaques, H. E., 761.
Jardine, J. T., 599.
Jardine, W. M., 190.
Jarosch, 81.
Jarrell, T. D., 386.

Jarvis, E., 758.
Jean, F. C., 29.
Jeffs, R. E., 729.
Jenkins, A. E., 350.
Jenkins, E. H., 1, 98, 124, 647, 696.
Jenkins, H. F., 697.
Jennings, A. C., 789.
Jennings, D. S., 16.
Jennings, H. S., 567.
Jensen, C. O., 820.
Jensen, H. O. S.–, 76.
Jensen, O.–, 176.
Jenvey, B. G., 176.
Jesness, O. B., 190, 293.
Jeter, F. H., 231.
Jobling, J. W., 263.
Jochems, S. C. J., 144.
Joffe, J., 625.
Joffe, J. S., 624.
John, A. O.–, 171.
Johns, C. O., 258, 865.
Johnson, 394.
Johnson, A. G., 643.
Johnson, A. H., 196.
Johnson, E., 590.
Johnson, E. C., 298, 492.
Johnson, E. M., 397.
Johnson, F. R., 141.
Johnson, H. W., 722.
Johnson, J., 248, 643.
Johnson, S. W., 3.
Johnson, W. C., 65.
Johnson, W. T., 97, 395, 599.
Johnstin, R., 114.
Johnston, D. P., 688.
Johnston, E. S., 220.
Johnston, W. L., 166.
Johnstone, M. C., 176.
Jones, C., 239.
Jones, C. R., 800.
Jones, D. B., 714, 865.
Jones, E. E., 769.
Jones, E. P., 718.
Jones, E. R., 285, 686.
Jones, E. S., 749.
Jones, G. B., 315, 511.
Jones, H. A., 137.
Jones, J. H., 664, 665.
Jones, J. W., 433.
Jones, L. H., 627.
Jones, L. K., 644, 645.
Jones, L. R., 240, 442, 644.
Jones, M. G., 827.
Jones, R., 452.
Jones, R. J., 486.
Jones, S. C., 397.
Jones, T. H., 657.
Jones, W., 112.
Jordan, E. O., 125.
Jordan, J. O., 277.
Jordan, K. H. C., 654.
Jordan, W. H., 596.
Jorgensen, G., 805.
Jørstad, I., 645.
Joshi, N. V., 121.
Jost, L., 125.
Joy, G. C., 142.
Joyeux, C., 400.
Judd, C. S., 143.
Jull, M. A., 165, 200, 673, 674, 864.
Juritz, C. F., 378.
Jurney, R. C., 315.
Justin, J. D., 587.
Justin, M. M., 299.

Kakizaki, Y., 137.
Kalkus, J. W., 278, 884.
Kalning, H., 114.
Kammerer, P., 66.
Kammlade, W. G., 774.
Kampp, R., 897.
Kanhäuser, F., 517.
Kann, J. H. C., 687.
Kappeller, G., 611.
Kappert, H., 222, 228.
Karel, K., 511.
Karsten, G., 125.
Kasai, M., 544.
Katchinsky, N. A., 211.
Kauffman, A. B., 462.
Kaupp, B. F., 373, 471, 787.
Kawakami, Z., 499.
Kayser, E., 18.
Kearney, T. H., 226.
Keeling, I., 396.
Keeney, M. H., 99.
Kegerreis, C. S., 85.
Keghel, M. de, 83.
Keil, J. B., 234, 497, 632.
Keil, J. M., 339.
Keitt, G. W., 644.
Keller, H., jr., 172.
Kelley, W. P., 318, 319.
Kelley, W. S., 196.
Kellner, O., 67.
Kellogg, J. W., 215, 218.
Kelly, E., 698, 878.
Kelly, J. G., 396.
Kelly, J. W., 22.
Kelser, R. A., 684.
Kempster, H. L., 288, 574.
Kendall, A. I., 609, 610.
Kendall, F. E., 673.
Kendall, H. S., 385.
Kendall, J. C., 395.
Kendrick, J. B., 246.
Kennard, D. C., 273, 673, 674.
Kennedy, P. B., 19, 228, 229.
Kent, H. L., 800.
Kern, O. J., 96, 195.
Kerr, J. M., 173.
Kerr, R. H., 410.
Kerr, W. J., 800.
Kestner, O., 561.
Kestranek, W., 803.
Khalil, M., 499.
Khan, A. R., 231.
Khare, J. L., 849.
Kidder, A. F., 271, 824.
Kielstra, 398.
Kiernan, J. A., 282, 700.
Kiesselbach, T. A., 225.
Kihara, H., 25.
Kli, N., 283.
Kilbourne, C. H., 276.
Kilgore, B. W., 99, 497, 798.
Killby, L. G., 331.
Kimball, D. S., 704.
Kimball, H. H., 718.
Kimball, O. P., 769.
Kincer, J. B., 313.
King, C. J., 246.
King, (Mrs.) F., 836.
King, F. G., 267.
King, G. E., 659.
King, H. D., 568.
Kinney, E. M., 765.
Kipps, M. S., 900.
Kirby, A. H., 31.
Kirkpatrick, R. Z., 718, 719.
Kirkwood, J., 292.
Kistler, P. T., 498.
Kitajima, 155.
Klaphaak, P. J., 647.
Kleine, R., 156.
Klimmer, M., 278.
Klinck, L. S., 200.
Kling, A., 805.
Knapp, B., 600, 800.
Knapp, G., 882.
Knight, E. W., 621, 630, 636, 696.
Knight, H. G., 800.
Knight, L. I., 437.
Knight, R. C., 521.
Knipovitch, B. N., 292.
Knipping, H. W., 560, 561.
Knobel, A., 95.
Knox, W. W. N., 862.
Kocher, A. E., 721.
Koestler, G., 605.
Kohman, E. F., 563, 856.
Kohn, F. J., 499.
Kok, J., 474.
Kolb, J. H., 690, 893.
Kolle, W., 177.
Kollmann, O., 819.
Kolthoff, I. M., 803.
Kondō, M., 632, 633.
König, J., 559.
Konsuloff, S., 50.
Kooiman, H. N., 822.
Kopec, S., 266.
Kopeloff, N., 363.
Kopke, E. W., 444.
Korenchevsky, V., 65.
Korstian, C. F., 755.
Koschmieder, H., 82.
Koskowski, W., 261.
Kostyschew, S., 126.
Kotila, J. E., 443, 844.
Kotok, E. I., 509.
Kotzé, J. J., 342.
Kraker, J. L., 438.
Kramer, O., 834.
Krantz, F. A., 133, 332, 333.
Kratz, A. P., 185, 288.
Kraus, E. J., 630.
Kraus, W., 812.

Krause, J., 86.
Krauss, F. G., 572.
Kraybill. H. R., 328, 741.
Krige, G. J. R., 726.
Krische, P., 215.
Krogh, A., 251.
Krout, W. S., 198, 246.
Krusekopf, H. H., 616.
Krzywanek, F. W., 863.
Kufferath, M., 545.
Kulp, W. L., 309.
Kunst, F., 200.
Kurtenacker, C., 802.
Kuwana, I., 355.
Kuwatsuka, K., 546.
Kuyper, J., 20.

Laake, E. W., 356.
Lacey, M. S., 651.
Lacy, M. G., 559.
Ladebeck, E., 574.
Lafene, B. W., 397.
Lafferty, H. A., 543.
LaForge, F. B., 507.
Laing, E. V., 537.
Lair, M., 594.
Lake, G. C., 479.
LaMaster, L. P., 375.
Lambert, E. B., 196, 645.
Lambert, S. M., 788.
Lamson, G. H., jr., 56.
Lamson, P. D., 382.
Lander, P. E., 118, 121, 415.
Landis, B. Y., 893.
Landon, I. K., 98.
Lane, A. C., 510.
Lane, C. H., 194.
Lane, J. H., 310, 608, 715.
Lang, 252.
Lang, W. H., 125.
Lange, L. B., 859.
Langeron, M., 400.
Langford, E. W., 603, 606.
Langmack, P. V. F. P., 174.
Langston, J. M., 759.
Langworthy, C. F., 65, 492, 560, 596.
Lanman, F. R., 596.
Lantow, J. L., 197.
Lapham, M. H., 616.
Larrier, L. N., 179, 500.
Larrimer, W. H., 344.
Larsen, O. H., 89.
Larsen, R., 199.
Larson, C. W., 390.
Larson, J. L., 686.
La Rue, C. D., 523.
Lassieur, A., 805.
Lathrop, E. A., 296.
Lathrop, F. H., 197, 353.
Lathrop, F. W., 797.
Latshaw, W. L., 22, 518.
Laufberger, W., 565.
Laughlin, H. H., 568.
Laur, E., 389.
Lauritzen, J. I., 754.
Lavedan, L. J., 590.
Lavergne, H., 82.
Lavier, G., 400.
Lawrence, J. B., 26.
Laxa, O., 804.
Layton, H. B., 299.
Lazitch, J., 279.
Leach, B. R., 657.
Leach, H. R., 719.
Leake, H. M., 295.
Leanati, L., 177.
Le Baron, 253.
LeBeau, C., 31.
Lecomte du Noüy, P., 110.
Lecomte, H., 440.
Ledlie, R., 835.
Lee, H. A., 444, 500.
Lee, S. M., 887.
Lees, A. H., 48, 49, 649, 660.
Lees, S., 589.
Leete, C. S., 699, 878.
Leeuwen, E. R., Van, 452.
Leggett, E. A., 14.
Legrand, L., 567.
Lehman, H. H., 482.
Lehmann, E. W., 284.
Leibold, A. A., 278.
Leidigh, A. H., 33.
Leighton, A., 716.
Leighton, G., 607.
Leighton, G. R., 862.
Leighty, C. E., 343, 541, 841.
Leissner, G. N., 232.
Leitch, A., 592, 797.
Leith, B. D., 629.
Leland, O. M., 492, 596.
Lemaire, M. V., 400.
Lemarié, C., 400.
Lemmermann, 631.
Leonard, L. T., 655, 751
Leplae, E., 141.
Leroy, A.–M., 269.
Lesage, P., 817.
Lesbre, F.–X., 278.
Lesley, J. W., 753.
Leslie, W. R., 734.
Lesné, E., 666.
Levaditi, C., 378, 782.
Leven, G., 445.
Levene, P. A., 501.
Levine, C. O., 72.
Levine, M. N., 748, 840
Levy-Simpson, S., 806
Lewis, C. K., 795.
Lewis, H. B., 662.
Lewis, H. G., 616.
Lewis, H. R., 273, 776
Lewis, I. P., 338.
Lewis, P. A., 567.
Lewkowitsch, J., 608.
Leynen, E., 481.
Li, T. T., 42.
Lichtin, A., 503.
Lieben, F., 158.
Liehr, O., 19.
Lieske, R., 30.
Lignières, 380.
Lindberg, H., 434.
Lindemuth, L. M., 198.
Linden, Von, 81.
Lindfors, T., 39.
Lindhard, E., 335.
Lindinger, L., 50.
Lindsey, J. B., 167.
Lindskog, G. E., 208, 509.
Lindstrom, E. W., 630, 826
Line, J., 146, 649.
Linfield, F. B., 195, 708.
Link, K. P., 9.
Linlithgow, 677.
Linney, C. E., 207, 718.
Linstow, O. von, 811.
Lipman, J. G., 23, 99, 596, 707, 708, 818.
Lippincott, W. A., 98.
Lipschitz, W., 462.
Lipscomb, J. N., 488.
Little, C. C., 567, 769.
Little, R. B., 280.
Lively, C. E., 192, 705.
Lloyd, E. A., 593.
Lloyd, F. E., 239.
Lloyd, W. A., 492.
Locklin, H. D., 395, 599, 898.
Lockwood, W. P. B., 277, 700.
Loeb, J., 109.
Loeb, L., 567.
Loew, O., 124.
Loftfield, J. V. G., 28, 30, 422.
Löhnis, F., 221, 819.
Long, A. W., 51.
Long, D. D., 231, 792.
Long, F., 29.
Longobardi, C., 604, 607.
Longuet, D.–J., 489.
Longwell, J. H., 199.
Loomis, H. F., 330.
Loomis, R., 293.
López, Domínguez, F. A., 35.
López Santiago, B., 149.
Lord, H. V. S., 439.
Lotsy, J. P., 821.
Lott, R. B., 56.
Love, H. H., 596.
Lovejoy, P. S., 616.
Loveland, G. A., 115.
Lovett, A. L., 156, 157, 254, 255, 357 555.
Lowden, F. O., 604.
Lowe, B. H., 15.
Lowry, M. W., 116.
Lucas, D. B., 698.
Luce, W. A., 199.
Luckett, J. D., 340, 535, 742.
Ludwig, C. A., 128, 647.
Lugo, F. O., 148.
Lühriq, H., 112.
Luithly, J. A., 99.
Lundagen, M. A., 58.
Lundegårdh, H., 421.
Lush, J. L., 260, 269, 871.
Lush, R. H., 397, 698.
Lusk, W. F., 899.

Lutjeharms, D., 28.
Lutman, B. F., 555.
Luyten, I., 127.
Lyman, G. R., 344.
Lyon, T. L., 235.

Mabire, A., 331.
McAdie, A., 314.
McAtee, W. L., 652.
McBain, J. W., 308.
McBride, O. C., 555.
McCall, M. A., 209, 223, 828.
MacCallum, B. D., 250.
MacCallum, W. G., 278.
McCampbell, C. W., 167, 868.
McCandlish, A. C., 164, 578, 778, 779.
McCarrison, R., 561, 885.
McCarthy, E. F., 509.
McCaustland, E. J., 596.
McClary, J. A., 734, 832.
Maclay, E., 199.
McClellan, L. N., 886.
McClelland, T. B., 150.
McClintock, J. A., 648.
McClung, C. E., 567.
McCollam, M. E., 97, 395, 599, 898.
McColloch, J. W., 657.
McCollum, E. V., 263, 765.
McConnell, P., 193.
McCool, M. M., 16, 215, 419, 616, 898.
McCreary, O., 199.
M'Cubbin, G. A., 588.
McCue, C. A., 799.
McCune, A. J., 383.
McCurdy, J. C., 890.
MacDaniels, L. H., 639.
McDonald, A. H. E., 329.
MacDonald, P., 198.
McDonald, R. E., 255.
McDonnell, H. B., 66.
MacDougal, 28.
McDougall, W. B., 523.
MacDowell, E. C., 567.
McDowell, M. S., 596.
Macek, J., 891.
M'Fadyean, J., 381.
McFarland, J. H., 438, 743.
McGee, J. M., 728.
McGinnis, F. W., 821.
McGinty, R. A., 137.
McGowan, J. P., 682.
Mach, F., 407.
MacHanson, 890.
McHargue, J. S., 202, 730.
McIndoo, N. E., 448.
McInerney, T. J., 276.
MacIntire, W. H., 124, 413.
McKee, C., 129.
McKee, R., 828.
Mackenzie, W. L., 377.
McKillop, A. T., 131, 842.
McKinney, H. H., 343, 344.
Mackintosh, J., 780.
McLachlan, A., 227.
McLaine, L. S., 848.
McLean, A. J., 382.
McLean, D. L., 384.
Macleod, A., 297.
MacLeod, G., 457.
MacLeod, G. F., 552.
MacMillan, A. A., 67.
McMurry, F. M., 704.
McNall, P. E., 690.
McNatt, H. E., 72, 375, 599.
McNease, B. W., 561.
Macomber, D., 568.
Macoun, W. T., 100.
McRostie, G. P., 442.
McWhorter, F. P., 444.
Macy, H., 678.
Maenhaut, J., 603.
Magistad, O. C., 622.
Magnus, W., 221.
Magrou, J., 819.
Magruder, R., 198.
Maguire, L. C., 78.
Maheux, G., 848.
Mahin, E. G., 407.
Mains, E. B., 442.
Major, F., 609.
Malarski, H., 172, 175.
Malcolmson, V. A., 191.
Mallet, L., 808.
Mallmann, W. L., 483.
Malloch, J. R., 652.
Mallon, M. G., 59.
Mally, C. W., 450.
Maltby, R. D., 492.
Malthus, T. R., 295.
Mandekic, V., 225, 330.
Mangelsdorf, P. C., 632, 826.
Mangin, L., 440.
Manhart, V. C., 177.
Manley, P. C., 900.
Mann, A. R., 492, 596, 799, 800.
Mann, C. R., 596.
Mann, M. C., 770.
Mann, P. L., 697.
Manns, T. F., 243.
Mansfield, G. R., 817.
Manson, M., 15.
Manuel, H. L., 145.
Manvilli, V., 817.
Maphis, C. G., 796.
Marble, L. M., 39.
Marchal, E., 540.
Marchlewski, L., 160.
Margosches, B. M., 717.
Marine, D., 14.
Maris, P. V., 492.
Marlatt, A. L., 800.
Marquardt, J. C., 197.
Marsh, C. D., 583.
Marsh, H., 181.
Marsh, R. S., 436.
Marshall, G. A. K., 550.
Marshall, R. E., 889.
Marshall, W. K., 830.
Marston, A., 492.
Martin, J. H., 37, 335, 634.
Martin, J. P., 287.
Martin, M. E., 899.
Martin, R. D., 330.
Martin, V. G., 899.
Martin, W. H., 138, 148.
Martinet, G., 94.
Marvin, C. F., 509.
Mason, C. R., 198.
Masoni, G., 121.
Masson, C., 177.
Masuda (Baron), 499.
Masurovsky, B., 677.
Matheson, K. J., 878.
Matheson, R., 381.
Mathews, F. P., 899.
Mathews, O. R., 134, 418.
Mathot, 590.
Matignon, C., 214, 517.
Matsuo, T., 182.
Mattei, P. di, 663.
Matthews, E. N., 795.
Matthews, M. L., 597.
Matthews, R., 485.
Mattick, E. C. V., 475.
Mattill, H. A., 459, 663, 857.
Mattoon, W. R., 342.
Mattos Filho, B. de, 413.
Matz, J., 539.
Maule, H. P. G., 287, 487.
Maung Ba Gyaw, 586.
Maver, M. E., 379.
Maw, W. A., 673.
May, H. G., 81.
May, W. L., 530.
Maynard, E. J., 870.
Maynard, L. A., 178, 369, 778.
Mayné, R., 548.
Mayor, A., 94.
Mead, C. W., 56.
Mead, E., 89.
Meadows, W. R., 33, 331.
Mecum, W. D., 760.
Mees, R., 331.
Megee, C. R., 37.
Meigs, E. B., 72, 605.
Meisinger, C. L., 509.
Meister, G., 36.
Melander, A. L., 251, 452.
Meldrum, A. N., 609.
Mellanby, E., 65.
Mello, U., 284.
Mendel, L. B., 62, 161, 360.
Mendiola, N. B., 238.
Mendum, S. W., 88.
Menéndez Ramos, R., 324, 599.
Merchant, C. H., 698.
Meredith, E. T., 190.
Merrill, J. H., 251, 357.
Metalnikov, S., 155.
Metcalf, W., 98.
Metzger, J. E., 334.
Metzger, W. H., 198.
Meyer, C. C., 392.
Meyer, E., 486.
Meyer, E., jr., 190.
Meyer, F., 517.
Meyer, G., 560.

Meyer, H., 501.
Meyer, J. R., 476.
Meyer, K. F., 859, 860, 861, 862, 863.
Michael, G. W., 593.
Michael, L. C., 93.
Michel, P., 58, 365, 566.
Middleton, T. H., 290.
Midgley, T., jr., 387.
Mieczynski, T., 116, 210.
Miège, E., 736.
Miessner, H., 481.
Milbrath, D. G., 346.
Miles, G. F., 198.
Milks, H. J., 178.
Millard, W. A., 646.
Miller, C. C., 498.
Miller, D., 56.
Miller,E. J., 505.
Miller, E. M., 94.
Miller, E. W., 662.
Miller, H. G., 464, 568.
Miller, J. D., 605.
Miller, L. B., 811.
Miller, M. F., 397.
Miller, M. R., 582, 583.
Miller, O. D., 793.
Miller, P. L., 196.
Miller, R. B., 341.
Miller, R. C., 497, 900.
Milligan, S., 194.
Milne, D., 31.
Milner (Lord), 295.
Milum, V. G., 653.
Milward, R. C., 441.
Minot, A. S., 114.
Miserez, H., 95.
Misner, E. G., 577.
Misra, C. S., 851.
Mitchell, C. A., 377, 608.
Mitchell, H. H., 158, 673.
Mitscherlich, E. A., 815.
Mitsui (Baron), 499.
Miyadera, K., 58.
Miyagi, O., 83.
Miyake, K., 419, 528.
Moczarski, 677.
Moe, G. G., 130.
Mohler, J. R., 604.
Mohr, O. L., 770.
Mokragnatz, M., 520.
Möller, H. P., 218.
Mollo, A., 172.
Monaco, E., 817.
Monier-Williams, G. W., 286, 608.
Monro, T. K., 862.
Monroe, W. M., 853.
Montemartini, L., 844.
Montgomery, C. W., 733, 792, 798.
Montgomery, E. G., 31, 596.
Moody, W. J., 278.
Mooers, C. A., 498.
Moore, E., 193.
Moore, H. C., 97, 332.
Moore, H. D., 880.
Moore, J. H., 603.
Moore, J. S., 471.
Moore, M., 374.
Moore, R. A., 31.
Moore, V. P., 600.
More, A., 203.
Moreau, E., 113.
Moreau, L., 649.
Morettini, A., 45, 826.
Morgan, B., 697.
Morgan, G., 130, 136.
Morgan, M. F., 299.
Morgan, T. H., 266.
Morgulis, S., 14.
Mori, S., 461.
Morimoto, Y., 205.
Morinaka, K., 767.
Morkel, W. A. K., 272.
Morris, G. W., 191.
Morris, H., 881.
Morris, H. E., 646, 750.
Morris, O. M., 223, 232, 248, 755.
Morrison, E., 851.
Morrison, F. B., 167, 672, 675, 696, 874.
Morrison, H., 851.
Morrison, W., 500.
Morrow, C. A., 503.
Morse, F. W., 518.
Morse, M., 299.
Morse, S. F., 518.
Morse, W. J., 35, 232.
Mortara, G., 693.
Mortimer, G. B., 629.
Morton, J., 500.
Morton, J. S., 500.
Moseley, T. W., 875.
Moss, E. G., 231.
Mosséri, V. M., 647.
Mote, D. C., 155.
Mottram, J. C., 61.
Mouriquand, G., 58, 365, 566.
Mudge, C. S., 716.
Mueller, J. H., 714.
Muenscher, W. C., 426.
Muesebeck, C. F. W., 855.
Muir, G. W., 67.
Müller, E., 457.
Muller, H. J., 266, 462, 567.
Müller-Thurgau, H., 144.
Mumford, F. B., 596, 799.
Mumford, H. W., 800.
Münchmeyer, G., 692.
Muncie, J. H., 348.
Muñoz del Castillo, J., 217.
Munro, H. K., 156.
Munro, J. W., 837.
Munro, W. A., 734, 832.
Murchie, M. I., 797.
Murdock, H. E., 184.
Murlin, J. R., 459.
Murphy, H. F., 420, 433.
Murphy, P. A., 753, 844.
Murray, J. K., 176.
Murray, J. M., 128.
Musart, C., 91.
Musbach, F. L., 623.
Mussehl, F. E., 373, 374.
Musselman, H. H., 487.
Muttelet, C. F., 112.
Myddleton, W. W., 507.
Myler, W. M., jr., 688.
Mylius, G., 332.

Nabenhauer, F. P., 197.
Nagai, I., 26, 530.
Nagant, H. M., 417.
Nagao, M., 787.
Nakamura, N., 81.
Nakamura, Y., 283.
Nanussi, A., 505.
Nash, F., 887.
Nash, S. W., 71.
Nason, W. C., 694.
Nattan-Larrier, L., 179, 500.
Naumann, W. R., 197.
Navel, H. C., 539.
Naylor, N. M., 10.
Neal, D. C., 441.
Neale, P. E., 197.
Nebolsin, S. I., 229.
Needham, J., 803.
Neidig, R. E., 770, 771.
Neifert, I. E., 456.
Neill, A. J., 880.
Neiswander, C. R., 198.
Nelson, E. N., 478, 665.
Nelson, I., 197.
Nelson, J. B., 397.
Nelson, M., 809.
Nelson, N. T., 630.
Nelson, P., 413.
Němec, A., 511.
Nesbitt, L. L., 497.
Neser, C. P., 683.
Nettleton, L. B., 198.
Newcomb, M. J., 198.
Newcombe, F. C., 220.
Newell, F., 662.
Newell, W., 547, 800, 898.
Newsom, I. E., 283, 476.
Newton, R., 796.
Newton, R. G., 734.
Nice, L. B., 880.
Nichols, S. P., 522.
Nicolau, S., 378, 782.
Niemes, P., 161.
Nieuwland, N. B. –, 16.
Nightingale, G. T., 739.
Nightingale, W. I., 223.
Nikolić, M., 335.
Nilsson-Leissner, G., 232.
Nishikado, Y., 547.
Nishimura, M., 528.
Nixon, L. M., 66.
Nixon, R. L., 33.
Noack, K. L., 127.
Nobles, C. R., 900.
Nodder, C. R., 33.
Noer, O. J., 99.
Noffray, E., 839.
Noguès, 332.
Nolan, W. J., 357.
Nolen, R. E., 899.

Noll, C. F., 726.
Nomi, S., 182.
Norling, S., 686.
Norris, E. R., 11.
North, M. F., 99.
Northrop, J. H., 802.
Nottin, P., 215.
Nourse, E. G., 98, 196, 293.
Noüy, P. L., du, 110.
Novák, V., 811.
Noyes, W. A., 114.
Nunn, R., 508.
Nuszbaum, C., 188.
Nuttall, G. C., 835.
Nutting, G. B., 646.

O'Brien, P. J., 537.
O'Dell, J. H., 453.
Odland, T. E., 199.
Ogata, D., 159.
Ohahi, M., 782.
O'Kane, W. C., 510, 853.
O'Kelly, J. F., 32, 414, 428.
Oliver, A. W., 373.
Olsen, A. G., 856.
Olsen, C., 618.
Olson, G. A., 830.
Olson, O., 737.
Olson, T. M., 579.
Omori, K., 499.
O'Neal, A. M., 415, 616.
O'Neal, A. M., jr., 318.
Oordt, G. J. Van, 256.
Oosthuizen, J. du P., 36.
Opsahl, W., 745.
Orcutt, M. L., 280, 884.
Orla-Jensen, 176, 607.
Orloff, A. S., 191.
Ormandy, W. R., 203.
Orner, A. J., 790.
Orr, J. B., 65.
Orton, C. R., 443.
Orton, W. A., 751.
Orwin, C. S., 692.
Osborne, T. B., 62, 98, 161, 360.
Osenbrug, A., 129.
Osterberg, E., 859.
Osterwalder, A., 144.
Ostrander, J. E., 208, 509, 719.
Osugi, S., 418.
Ototzky, P., 789.
Overmyer, C. J., 397.
Owen, R. M., 606.
Owen, W. L., 613, 614.
Owen-John, A., 171.
Owl, W. D., 894.

Pack, A. N., 341.
Pack, C. L., 51.
Pack, H. J., 151, 198.
Page, H. J., 203, 608.
Palfreman, L., 143.
Palm, B. T., 148, 246.
Palmer, C. C., 482.
Palmer, E. F., 436.
Palmer, L. S., 74, 75.
Palmer, M. G., 260.
Palmer, S., 364.
Pammel, L. H., 178.
Panisset, L., 178, 180.
Pap, E., 66.
Pape, 841, 842, 844, 847.
Pappenheimer, A. M., 65.
Paquot, R., 78.
Parhon, M., 765.
Park, E. A., 365.
Park, O. W., 496.
Parker, F. W., 623, 722.
Parker, J. R., 450.
Parker, R. B., 256.
Parker, S. L., 568, 667.
Parker, T., 51.
Parks, T. H., 657.
Parman, D. C., 356.
Parnell, F. R., 34.
Parrott, P. J., 39, 49, 53, 97, 152.
Parshall, R. L., 82.
Parsons, T. R., 559.
Partridge, N. L., 237.
Partridge, S. W., 299.
Patch, E. M., 652, 657.
Patel, P. G., 156, 157, 158.
Patrick, A. L., 720.
Patrie, C. R., 447.
Patterson, H. J., 4, 196, 599.
Patterson, W. H., 654.
Patton, W. S., 55.
Pattullo, T. D., 838.
Payne, L. F., 98, 194.
Peacock, N. D., 900.
Pearce, J. N., 811.
Pearl, R., 568, 667.
Pearson, G. A., 641.
Pearson, N., 297.
Pearson, R. A., 706, 711, 799.
Pécaud, 135.
Peck, F. W., 705, 799.
Peirce, F. T., 131.
Peitersen, A. K., 441.
Peltier, G. L., 846.
Pelton, W. C., 498.
Pennington, S., 247.
Peren, G. S., 235.
Perey, M., 515.
Perkins, M. E., 112.
Perkins, W. R., 492, 800.
Perlzweig, W. A., 880.
Perrine, N., 456.
Perry, E. J., 99, 197.
Perry, F. R., 332.
Perry, G. E., 143.
Perry, W., 670.
Pessôa, S. B., 476.
Petch, C. E., 442.
Petch, T., 152.
Peter, 657.
Peter, A. M., 273.
Peters, 843.
Petersen, K. D., 232.
Petersen, W. F., 78.
Peterson, A., 353, 356.
Peterson, A. J., 57.
Peterson, W. H., 201, 669.
Pethybridge, G. H., 751.
Petit, A., 512, 515.
Pettey, F. W., 153, 759.
Pettit, R. H., 53, 495, 898.
Petty, B. H., 888.
Pfaff, F., 81.
Pfeiler, W., 179.
Philips, F. R., 297.
Phillips, H. A., 338.
Phillips, H. M., 494.
Phillips, T. G., 801.
Phillips, W. J., 558.
Philp, T., 179.
Piccioli, L., 837.
Pichard, G., 39, 515.
Pichard, M., 611.
Pickett, B. S., 196.
Piedallu, A., 455.
Pierson, A. H., 239.
Pierson, J., 498.
Pieters, A. J., 32, 200.
Pike, E. F., 379.
Pillers, A. W. N., 76.
Pinchot, G., 603.
Pinckney, R. M., 553.
Pinkerton, T. C., 422.
Piper, C. V., 35.
Pirsch, G. B., 659.
Pirtle, T. R., 675.
Pitman, G. W., 718.
Pittman, D. W., 620.
Platt, W., 455.
Plunkett, C. H., 897.
Plunkett, H., 192.
Plymen, F. J., 122.
Poels, 81.
Poeteren, N. van, 242.
Poher, M., 475.
Pokrowsky, W., 231.
Polak, M. W., 485.
Policard, A., 408.
Poma, G., 730.
Pomeroy, C. S., 742.
Ponniah, D., 855.
Pontius, B. E., 878.
Pool, G. E., 471, 874.
Pool, R. J., 28.
Pool, W. A., 179.
Poole, G. E., 874.
Poos, F. W., 558.
Pope, M. N., 219.
Pope, W. T., 641.
Popenoe, W., 426.
Porcher, C., 311, 603, 604, 606, 607.
Porte, W. S., 844.
Porter, B. A., 556.
Pospelov, V. P., 455.
Possen, R. J., 699.
Potter, A. A., 596, 800.
Potter, E. L., 373.
Potter, G. F., 327.
Pound, G. H., 388.
Powdermaker, F., 99.
Powell, G. H., 37.
Powers, W. L., 510, 588.

Praigg, N. T., 190.
Prebisch, R., 296.
Preble, E. A., 652.
Prentice, D. S., 278.
Prescott, M. S., 72.
Price, H. B., 490.
Price, O. B., 431.
Price, W. H., 276, 699.
Price, W. V., 475.
Pridham, J. T., 329.
Priestley, J. H., 522.
Prince, A. L., 813.
Pringsheim, H., 803.
Pritchard, F. J., 844.
Pritchett, G. H., 444.
Probey, T. F., 479.
Proulx, E. G., 727, 771.
Puchner, H., 141, 812.
Pugsley, C. W., 198, 392, 491, 492.
Punnet, 66.
Punnett, R. C., 674.
Purdy, M. A., 660.
Purnell, F. S., 707.
Putnam, G. E., 794.
Putnam, G. W., 97.
Putterill, V. A., 249.
Pyle, R., 438.

Qayum, A., 322.
Quaintance, A. L., 152.
Quanjer, H. M., 398, 753.
Quayle, H. J., 849.
Queuille, M., 192, 892.
Quinlan, J., 680.
Quinnell, W. C., 570.

Rabaud, E., 568.
Rabbas, 252.
Rader, F. E., 426, 434.
Radspinner, W. A., 138, 529.
Rae, K. T., 734.
Ragsdale, A. C., 73, 173, 283, 374, 375, 878.
Rahm, F., 818.
Rahman, S. A., 529.
Raillet, A., 400.
Railliet, A., 283.
Rainey, D. F., 97.
Ralfs, E. M., 540.
Ram, B., 240.
Ramann, E., 814.
Rambousek, F., 253.
Ramiah, K., 34.
Ramirez, J. H., 23.
Ramos, R. M., 324, 599.
Ramsay, A. A., 145.
Ramsbottom, J., 424.
Ramsower, H. C., 800.
Randall, C. E., 238.
Randolph, L. F., 423.
Rands, R. D., 150, 446.
Rankin, J. O., 189, 595.
Rankin, W. H., 546, 839.
Rao, K. A., 122.
Rasmussen, M. P., 692.
Rather, H. C., 97.
Ravenna, C., 203.
Rayburn, A. B., 496.
Raymond, A. G., 277.
Rayner, M. C., 424,522.
Rea, G. H., 357.
Read, B. E., 660.
Read, J. W., 364,668.
Reber, L. E., 800.
Recknagel, A. B., 142.
Record, S. J., 143, 440, 744.
Reed, F. H., 734, 832.
Reed, H. J., 599.
Reed, H. S., 628, 729, 730.
Reed, J. O., 506.
Reed, W. W., 509.
Reeder, G., 207.
Reese, H. C., 506.
Reese, M. J., 492.
Regan, W. S., 254, 852.
Reich, F. W., 719.
Reichel, J., 478.
Reid, F. R., 324.
Reid, K. L., 195.
Reidemeister, W., 611.
Reilly, E. E., 592.
Reinoehl, C. M., 694.
Remler, R. F., 888.
Remy, T., 216, 517.
Renouard, A., 528.
Reppert, R. R., 451.
Réthly, A., 718.
Rettger, L. F., 179, 784.
Rey, R. C. –, 389.
Reyes, L. J., 143.
Reynaud, 499.
Reynolds, A., 96.
Reynolds, E. B., 33.
Reynolds, R. V., 239.
Rhode, C. S., 576.
Rhodes, W. H., jr., 231.
Rhodin, S., 735.
Rhumbler, L., 50.
Ricardo, D., 295.
Rice, F. E., 712.
Rice, L., 657.
Richards, B. L., 347.
Richards, C. R., 492.
Richardson, A. C., 863.
Richardson, A. E. V., 736.
Richardson, B. T., 492.
Richardson, C. H., 550.
Richmond, H. D., 611.
Ricks, J. R., 495.
Riddick, W. C., 99, 497.
Rider, A. J., 712.
Riehm, E., 540, 839, 840, 841, 842.
Riggs, W. M., 799, 800.
Riker, A. J., 645.
Riley, C. V., 253.
Riley, H. W., 483, 890.
Riley, W. A., 800.
Rimoldi, F. J., 197.
Rindell, A., 726.
Ripperton, J. C., 411.
Ritchie, L. M., 184.
Ritzman, E. G., 370.
Rivera, A., 279.
Rivera, V., 230.
Rivers, O., 168.
Rivière, G., 39, 515.
Roach, W. A., 152.
Roadhouse, C. L., 276, 277, 700.
Robbins, E. T., 697.
Robbins, W. J., 627.
Roberts, E. J., 372.
Roberts, R. H., 140, 639, 644.
Robertson, G. S., 20, 202.
Robertson, J. W., 200.
Robertson, R. C., 460.
Robertson, W. A., 43.
Robinson, G. W., 316.
Robinson, H. G., 247.
Robinson, J. E., 793.
Robinson, T. R., 41.
Robinson, W., 848.
Robison, R., 410.
Rock, J. F., 426.
Rodger, A., 43.
Roe, H. B., 384, 685.
Roebuck, A., 256.
Roethe, H. E., 590.
Rogers, A. W., 123.
Rogers, H., 113.
Rogers, H. W., 773.
Rokahr, M., 297.
Rolfs, P. H., 140.
Romaine, J. D., 498.
Rondoni, P., 783.
Root, A. I., 762.
Root, C. J., 508, 718.
Root, E. R., 762.
Rosa, J. T., jr., 229.
Rose, F., 596.
Rose, H., 717.
Rose, M. S., 457.
Rose, R. E., 218.
Rosenblatt, M., 221.
Rosenow, E. C., 679.
Rosetti, E., 421.
Rosinek, I. F., 699.
Ross, C. P., 383.
Ross, H. A., 576.
Ross, P. H., 396.
Ross, W. A., 848.
Roth, F. C., 51.
Roth, W., 110.
Rothéa, 370.
Rother, W. O., 836.
Rothfeld, O., 189.
Rothwell, G. B., 67.
Roubaud, E., 156.
Rouest, L., 230.
Rowlands, M. J., 672.
Rowley, F. B., 591.
Ruddick, J. A., 604.
Rudolfs, W., 18.
Ruehle, G. L. A., 878.
Rumsey, L. A., 110.

Runk, C. R., 600.
Rupprecht, G., 839.
Russell, E. J., 20, 514, 608.
Russell, E. Z., 373.
Russell, H. L., 491, 597, 696, 709.
Russell, J., 215.
Russell, N. J., 315.
Ruston, A. G., 189, 792, 793.
Rutgers, A. A. L., 141.
Rutherford, J. G., 399.
Rutherford, W. J., 894.
Ruzek, C. V., 316, 510.

Sabnis, T. S., 218.
Sachs, W. H., 809.
Sackett, R. L., 492, 596, 800.
Sackett, W. G., 412, 445.
Safford, W. E., 141.
Sagawe, 595.
St. John, J. L., 215, 265.
St. Minkiewicz, 252.
Sajous, P., 168, 175.
Saker, D. G., 778.
Salaman, R. N., 752, 753.
Sale, E. D. T., 836.
Saleeby, M. M., 132.
Salfelder, 179.
Salisbury, E. J., 417.
Salmon, E. S., 147.
Salmon, S. C., 657.
Sampson, H. C., 743.
Sampson, K., 647.
Samuel, G., 150.
Samuels, C. D., 622.
Sanborn, C. E., 558.
Sand, H. J. S., 308.
Sanders, D. A., 397.
Sanders, H. G., 875, 876.
Sanderson, A. R., 242, 548.
Sanderson, D., 391.
Sanderson, E. D., 492.
Sanderson, E. S., 179.
Sandiford, I., 57.
Sands, W. N., 895.
Sandsten, E. P., 433.
Sanford, G. B., 46, 47.
Santiago, B. L., 149.
Sarvis, J. T., 865.
Sasscer, E. R., 352.
Sato, M., 607.
Sato, S., 283.
Saunders, C. E., 130, 200.
Saunders, F., 737.
Saunders, F. R., 128.
Sauve, E. C., 85.
Savage, E. S., 778.
Savastano, G., 37, 835.
Savazzini, L. A., 565.
Savelli, R., 128.
Savin, W. H., 398.
Savini, E., 311.
Sawyer, A. M., 843.
Sax, K., 139.
Sayles, M., 596.
Scarth, G. W., 239.
Schaaf, M., 441.
Schaefer, O. G., 496.
Schafer, E. G., 223.
Schafer, J., 794.
Schäfer, L., 613.
Schaffner, J. H., 523.
Schellenberg, 250.
Schellenberg, H., 144.
Schenck, H., 125.
Schermer, 881.
Scherpe, R., 840.
Schikora, F., 381.
Schilletter, J. C., 697.
Schlumberger, 840.
Schmidt, B. C., 507.
Schmidt, K., 569.
Schmit-Jensen, H. O., 76.
Schneider, F., 376.
Schneider, J. E., 478.
Schneider, M., 274.
Schneidewind, 623.
Schoene, W. J., 451.
Schoenholz, P., 862.
Schoenmann, L. R., 616.
Schoevers, T. A. C., 149, 398.
Scholes, B. E., 494.
Schoppe, W. F., 99, 171.
Schoth, H. A., 530, 828.
Schreiner, O., 815.
Schrepfer, H., 736.
Schribaux, 135.
Schroeder, E. C., 700.
Schroeder, H., 218.
Schulte, J. I., 897.
Schultz, E. S., 247.
Schultz, O. T., 462.
Schultz, W., 165.
Schulze, H., 157.
Schuster, A., 569.
Schuster, C. E., 535.
Schwartz, B., 76.
Scofield, H. H., 687.
Scofield, W. W., 175.
Scott, A., 308.
Scott, J. M., 873, 874.
Scott, J. P., 282, 680.
Scott, W. G., 132.
Scullen, H. A., 762.
Seabra, A. L. G. de, 93.
Seabright, J. K., 688.
Seaman, C. O., 277, 699.
Seamans, A. E., 129, 170, 371.
Seamans, H. L., 155, 759, 850.
Searles, E. M., 854.
Sebring, B. W., 66, 124.
Seely, F. B., 284.
Seese, P., 198.
Seín, F., jr., 252.
Selby, A. D., 497.
Selby, H. E., 485.
Sell, M. T., 664, 665.
Set, G. B., 741.
Sethi, D. R., 323.
Seurat, L.-G., 482.
Severance, G., 291.
Severin, H. C., 448, 549, 654.
Severy, H. W., 258.
Sewell, M. C., 332.
Seymour, G., 229.
Seymour, R. J., 459.
Shamel, A. D., 104, 742.
Shannon, R. C., 760.
Shantz, H. L., 426.
Shapovalov, M., 47.
Shaw, C. F., 34, 616.
Shaw, J. K., 138, 139.
Shaw, N., 614.
Shaw, R. S., 97, 495, 898.
Shchukin, D., 209.
Shear, E. V., 197.
Sheather, A. L., 785.
Shedd, O. M., 807.
Sheets, E. W., 867.
Shepard, H. H., 509, 719.
Sherlock, C. C., 391.
Sherman, C. B., 190.
Sherman, F., 757.
Sherman, H. C., 10, 364.
Sherman, J. M., 698.
Sherman, W. A., 793.
Sherrard, E. C., 206.
Sherwin, C. P., 501, 661.
Sherwin, M. E., 122.
Shevelev, I. N., 37.
Shigley, J. F., 900.
Shillinger, J. E., 76, 183, 684.
Shiple, G. J., 501.
Shive, J. W., 627.
Shively, E. T., 794.
Sholl, L. B., 178.
Shollenberger, J. H., 830.
Shorten, J. A., 160.
Shoup, G. R., 71, 87, 373, 576, 599, 874.
Shoup, (Mrs.) G. R., 71, 373, 576, 599, 874.
Show, S. B., 509.
Shull, A. F., 567.
Shull, G. H., 567.
Shutt, F. T., 65, 513.
Sieffert, L., 663.
Siegler, E. A., 350.
Sieglinger, J. B., 827.
Sierp, H., 127.
Sievers, F. J., 209, 211.
Signorelli, E., 282.
Silkett, R. J., 98.
Silver, J., 351.
Silzer, G. S., 197.
Simmonds, N., 263, 859.
Simmons, P., 853.
Simms, H. S., 501.
Simon, S., 380.
Simpson, G. C., 15.
Simpson, H. E., 207.
Simpson, J. S., 189, 792.
Simpson, S. L., 806.
Singh, K., 521.
Sinnott, E. W., 629, 822.
Sirodot, 133, 134.

Sivan, M. R. R., 123.
Sjogren, O. W., 791.
Sjollema, B., 762.
Skinner, J. H., 267, 800.
Skinner, J. J., 217, 324.
Slagg, C. M., 299.
Slate, W. L., jr., 98.
Slater, W. A., 285.
Slator, A., 608.
Slocum, A. H., 56.
Slocum, B. A., 97.
Slocum, R. R., 777.
Slonaker, J. R., 458, 766.
Small, J., 219, 835.
Smee, C., 153.
Smies, E. H., 416.
Smit, B. J., 679.
Smith, A., 295.
Smith, A. H., 59.
Smith, C. B., 492.
Smith, C. E., 855.
Smith, C. R., 550.
Smith, E. B., 384.
Smith, G. A., 285.
Smith, G. H., 584.
Smith, H. S., 496.
Smith, J., 612.
Smith, J. B., 370.
Smith, L. B., 454, 854.
Smith, L. J., 689.
Smith, M. I., 479.
Smith, N. R., 221.
Smith, R. C., 154.
Smith, R. E., 287.
Smith, R. H., 353.
Smith, R. I., 654.
Smith, R. S., 276, 277, 699, 700.
Smith, T., 280.
Smith, T. O., 349.
Smith, W., 715.
Smith, W. W., 195.
Smolík, L., 811.
Smulyan, M. T., 253.
Smyth, E. G., 761.
Smyth, H. F., 379.
Snapp, O. I., 659, 851.
Snedden, D., 295.
Snell, K., 332.
Snell, M. G., 197.
Snyder, B., 98.
Snyder, H. J., 616.
Snyder, R. M., 97.
Snyder, R. S., 198, 770, 771.
Soames, K. M., 61.
Sōma, S., 419.
Sommer, H. H., 73, 611, 679, 716.
Sorber, D. G., 410.
Souba, A. J., 569.
Soule, R. M., 116.
Sourisseau, J. H., 485.
South, F. W., 548.
Spaetgens, H., 692.
Speakman, M. T., 297.
Spek, J. van der, 17.
Spencer, G. J., 155, 848.
Spencer, H., 233.
Spencer, L., 132.
Spencer, R. R., 256.
Speyer, E. R., 254.
Spierenburg, D., 151.
Spillman, W. J., 89, 592.
Spinks, G. T., 44.
Spitz, 380.
Spoehr, H. A., 728.
Sponsler, O. L., 836.
Spragg, F. A., 32, 495.
Sprague, H. B., 197.
Spray, R. S., 681, 786.
Sproston, C. T., 277.
Squirrell, W. J., 825.
Staehelin, M., 655.
Stafseth, H. J., 482.
Stahel, G., 150.
Stakman, E. C., 146, 496, 645, 747, 840.
Stålfelt, M. G., 728.
Standley, P. C., 837.
Stanford, H., 900.
Staniland, L. N., 655.
Stanley, E. B., 196.
Stanley, L., 197, 711.
Stanton, C. A., 616.
Stanton, T. E., 384.
Staples, M. H., 295.
Starin, W. A., 881.
Stark, N., 880.
Starkey, E. B., 17.
Starkey, R. L., 625.
Starr, G., 196.
Stearns, L. A., 353.
Stebbing, E. P., 240, 745.
Steeg, T., 45, 796.
Steel, E. R., 481.
Steele, D. G., 463.
Steele, F. N., 382.
Steenbock, H., 167, 265, 664, 665, 672.
Steffen, G. I., 880.
Steinberg, R. A., 27.
Steiner, G., 357.
Stellwaag, F., 50.
Stenhouse-Williams, R., 607.
Stenton, R., 152.
Stephens, D. E., 828.
Stephenson, J. H., 589.
Stephenson, R. E., 98.
Steuart, D. W., 72.
Steudel, H., 458.
Steuert, L., 377.
Stevens, E. R., 643.
Stevens, F. L., 244.
Stevens, G. E., 408.
Stevens, H. P., 308.
Stevens, J. W., 626.
Stevenson, L., 297.
Stevenson, R. A., jr., 397.
Stevenson, W. H., 210, 596, 724, 810.
Stewart, C. P., 312.
Stewart, F. C., 39, 49, 53, 97.
Stewart, H. R., 688.
Stewart, J. T., 482.
Stewart, S., 824, 890.
Stewart, W. F., 95.
Stewart, W. P., 508.
Stieger, G., 191.
Stiles, G. W., jr., 679.
Stiles, W., 559.
Stillman, H. N., 286.
Stocking, W. A., 698.
Stockman, S., 179.
Stoddard, E. M., 534.
Stokes, W. B., 546.
Stokes, W. E., 823.
Stoklasa, J., 120.
Stone, H., 42.
Stone, N. C., 663.
Stone, R. W., 124.
Storey, G., 254.
Stout, A. B., 141, 237, 425.
Strahorn, A. T., 616.
Straight, E. M., 734, 832.
Strand, A. L., 198, 450.
Strauch, T. J., 699, 700.
Strawn, O. P., 900.
Streeter, L. R., 551.
Strickland, C. F., 93.
Strickland, L. F., 152, 442.
Stuart, H. C., 361.
Stuart, W., 736.
Stubbs, W. C., 737.
Stuckey, M. P., 598.
Stupart, F., 207.
Sturtevant, A. H., 266.
Succi, A., 246.
Sugiura, K., 160.
Sullivan, K. C., 253.
Summers, F., 833.
Summers, J. N., 657.
Sumulong, M. D., 683.
Sun, U. L., 331.
Sundararaman, S., 147.
Supplee, G. C., 75, 276, 277, 698, 700.
Sure, B., 668.
Surr, G., 417.
Sutcliffe, M., 548.
Suzuta, I., 633.
Swanson, C. O., 22, 98, 518.
Swanson, W. W., 200.
Sweeny, M. E., 596.
Sweet, A. T., 415.
Sweet, C. V., 84.
Swendsen, W. G., 383.
Swenehart, J., 687.
Swenk, M. H., 658.
Swingle, D. B., 146, 148, 471, 750, 874.
Swingle, W. T., 41.
Sydenstricker, E., 257.
Sylvan, P., 75.
Sze, T. P., 700.

Taber, R. F., 189.
Tacke, B., 812.
Taggart, J. G., 734, 832.
Taggart, W. G., 824.
Taguchi, K., 283.
Tanaka, T., 438.
Tanaka, U., 279.
Tang, C. Y., 796.
Tannehill, I. R., 207, 718.

Tanon, 500.
Tanquary, M. C., 357.
Tarr, L. W., 9.
Taruffi, D., 891.
Tattersfield, F., 152.
Taylor, A. E., 491, 719.
Taylor, C. C., 497.
Taylor, C. S., 725.
Taylor, F. E., 112.
Taylor, F. W., 328, 500.
Taylor, G. S., 821.
Taylor, H. C., 492, 591, 604, 705.
Taylor, J., 331.
Taylor, M., 12.
Taylor, W., 175.
Tegen, G., 144.
Tellefsen, M. A., 424.
Templeton, G. S., 600.
Terry, J., 397.
Thaden, J. F., 697.
Tharp, W. E., 616, 720.
Thatcher, L. E., 333, 738.
Thatcher, R. W., 2, 97, 197, 492, 551.
Thayer, P., 236.
Theiler, A., 607.
Thelen, R., 386.
Thiem, H., 50.
Thom, C., 163, 567.
Thomann, W., 166.
Thomas, B., 65.
Thomas, E. E., 319, 350.
Thomas, H. H., 836.
Thomas, J. M., 331.
Thomas, M. D., 16, 620.
Thomas, R. C., 648.
Thomas, W., 617.
Thompson, C. P., 468.
Thompson, G. E., 196.
Thompson, H. B., 299, 596.
Thompson, H. N., 143.
Thompson, N. F., 146.
Thompson, O. P., 277.
Thompson, R. B., 396.
Thompson, R. J., 895.
Thompson, W. C., 388, 777.
Thompson, W. O., 497.
Thompstone, E., 322.
Thomson, J. W., 657.
Thomson, M. R. H., 249.
Thornber, H., 136, 832, 833.
Thorne, C. E., 298, 404, 724, 738.
Thorne, G., 47.
Thornton, T., 734.
Thorp, W. P., jr., 273, 388.
Throckmorton, R. I., 518.
Thurgau, H. M. –, 144.
Thurman, B. H., 311.
Thurston, A., 407.
Thurston, F. M., 596.
Tibbetts, H. A. M., 81.
Tiebout, G. L., 824.
Tiemann, H. D., 440.
Tigert, J. J., 491.
Tilden, C. J., 83.
Tims, E. C., 644.
Tingey, P., 141.
Tinline, M. J., 832.
Tinline, M. S., 734.
Tisdale, W. B., 542, 838.
Tisdale, W. H., 343, 541, 841.
Tjebbes, K., 822.
Tochinai, Y., 146.
Toit, H. S. du, 192.
Tolaas, A. G., 332.
Tolley, H. R., 185.
Tolstoi, E., 363.
Tomura, T., 633.
Toomey, N., 455.
Topley, W. W. C., 584, 585.
Torgerson, E. F., 721.
Torrance, F., 377.
Torre, G. D., 176.
Torrey, R. E., 97.
Tothill, J. D., 50, 555.
Tottingham, W. E., 9.
Toumey, J. W., 440.
Tower, W. V., 698.
Toynbee, A., 295.
Toyoda, T., 181.
Tracy, P. H., 376, 679.
Traum, J., 79, 480, 481.
Travassos, L., 283.
Treherne, R. C., 453, 761, 848.
Trevan, J., 262.
Trevaskis, H. K., 294.
Triptolemo, 75.
Trostel, L. J., 387.
Troup, R. S., 42.
Trouvelot, B., 555.
Trowbridge, E. A., 864.
Truche, C., 886.
True, A. C., 1, 195, 605, 706.
Truffaut, G., 119, 213.
Trundy, J. H., 654.
Truog, E., 622, 815.
Tscherkes, L., 364.
Tsuji, M., 459.
Tsurumi, M., 181.
Tucker, C. M., 299.
Tufts, W. P., 235.
Tukey, H. B., 197, 340.
Tulaikov, N. M., 616.
Turner, C. W., 72, 73, 173, 374, 375, 464, 677, 878.
Turner, F., jr., 202.
Tyson, J., 215.
Tyzzer, E. E., 382.

Udall, D. H., 178.
Udden, A. D., 207.
Uhl, A., 803.
Umberger, H. J. C., 596.
Underhill, G. W., 451.
Unger, E. E., 207.
Unwin, A. H., 342.
Urbain, A., 886.
Usher, A. P., 616.
Utra, G. R. P. d', 36.
Vagliano, M., 666.
Vaile, R., 417.
Vallée, H., 282, 881.
van Amstel, J. E., 511.
van Beek, W. F., 781.
Van Breda de Haan, 246.
Vance, S. H., 700.
Van Citters, 398.
van Dam, W., 74, 376.
Van Deman, R., 391.
van der Spek, J., 17.
van der Walle, N., 260.
Van Dine, D. L., 850.
Van Duyne, C., 721.
van Hall, C. J. J., 144.
van Heerden, W. S., 168.
Van Hook, J. M., 145.
Vanino, L., 608.
Van Leeuwen, E. R., 452.
Van Norman, H. E., 277, 603, 604, 607, 699.
VanOordt, G. J., 256.
van Poeteren, N., 242.
Van Saceghem, R., 785.
Van Slogleren, 398.
Van Slyke, D. D., 497.
Van Slyke, L. L., 325.
Van Winkle, C., 476.
Van Zandt, J. P., 508.
Varley, J. R., 178.
Vass, A. F., 337, 429.
Vaughan, H. W., 496.
Vavilov, N. I., 822.
Vawter, L. R., 582, 583.
Vayssière, P., 154.
Veatch, J. O., 215, 415, 616, 898.
Veitch, F. P., 717.
Velling, A. J., 783.
Velu, H., 181, 400.
Vener, B., 277, 700.
Venkataraman, K., 127.
Verge, J., 78, 178, 180.
Verhoeven, W. B. L., 145.
Ver Hulst, J. H., 201.
Vernadsky, W. J., 212.
Vernon, J. J., 300.
Versluys, M. C., 127.
Verteuil, J. de, 827.
Veve, R. A., 52.
Vevers, G. M., 183, 499.
Veveu-Lemaire, M., 400.
Vicari, E. M., 568.
Viereck, H. L., 652.
Vigo, A. H. S., 734.
Vinageras, E., 737.
Vinal, G. W., 184.
Vincent, V., 619.
Vinet, E., 649.
Vinson, A. E., 317.
Vinson, C. G., 834.
Visco, S., 362.
Vivian, A., 492.
Viziolo, J., 150.
Votey, J. W., 799.
Vuillet, F., 82.

Wacker, L., 161.
Wadleigh, C. B., 297.
Wagner, P., 31, 624.
Wainwright, W. H., 689.
Waites, H., 14.
Waksman, S. A., 23, 625, 723.
Waldron, C. B., 800.
Walker, A. L., 197.
Walker, G. B., 428.
Walker, G. P., 50.
Walker, H., 120.
Walker, J. C., 644, 843.
Walker, M. N., 644, 646.
Wallace, H. A., 89.
Wallace, H. C., 395, 596, 603, 705.
Wallace, J. S., 65.
Wallace, Q. W., 870.
Wallace, T., 48, 833.
Wallace, V. O., 142.
Walle, N. van der, 260.
Waller, E., 74.
Wallin, I. E., 819.
Walls, E., 308.
Walmsley, F. D., 276, 699.
Walton, G. P., 309, 675, 713.
Walton, W. R., 652.
Wang, S. Y., 660.
Warburton, C., 256.
Warburton, C. W., 499.
Warburton, G. H., 608.
Ward, R. A., 295.
Ward, R. DeC., 808.
Wark, C. H., 625.
Warming, J., 190.
Warner, J. A. C., 887.
Warren, D. C., 397, 697.
Warren, G. F., 92, 596, 690.
Warren, G. L., 394.
Warthin, A. S., 681.
Warwick, B. L., 675.
Wason, I. M., 584.
Waterman, H. C., 714.
Waterman, W. G., 629.
Waters, H. B., 734.
Waterston, J., 255.
Watson, E. B., 415.
Watson, J. R., 847.
Watt, A., 615.
Watt, A. S., 536.
Watts, R. L., 298, 596, 832.
Way, C., 272.
Weatherwax, P., 528.
Weaver, E., 578.
Weaver, J. E., 29, 30.
Webb, H. W., 12.
Webb, R. W., 125.
Webber, H. J., 98.
Weber, A. D., 397, 698.
Weber, R. C. E., 685.
Webster, L. T., 79, 281, 282, 882.
Weed, A., 654.
Weeter, H. M., 477.
Weigel, C. A., 152, 658.
Weiman, A. C., 677.
Weimer, J. L., 540, 729.
Weinstock, M., 65, 365.
Weiske, F., 216.
Weiske, H., 669.
Weiss, 817.
Weiss, F., 443, 444.
Weiss, H. B., 56.
Weissenrieder, F. X., 268.
Welch, H., 178, 480.
Weld, I. C., 276, 700.
Weld, L. D. H., 605.
Wells, H. G., 379.
Wells, S. P., 845.
Wenholz, H., 265.
Weniger, F. C. –, 812.
Weniger, W., 343.
Wentworth, E. N., 269.
Werkman, C. H., 279.
Werner, C. A., 36.
Werner, H. O., 34.
Werth, C., 844.
Wertheimer, E., 766.
Wery, G., 598.
Westbrook, E. C., 90, 189, 231.
Wester, P. J., 56.
Westerdijk, J., 398.
Westley, R., 199.
Weston, L. H., 594.
Weston, W. H., jr., 46, 750.
Westover, K. C., 133.
Wetmore, A., 351, 675.
Weyl, 110.
Wheeler, E. W., 559.
Wheeler, H. J., 392, 438.
Wheeting, L. C., 215, 720.
Whelan, D. B., 397.
Wherry, E. T., 320.
Whetham, C. D., 312.
Whetzel, H. H., 240, 445.
Whinyates, L., 202.
Whitby, G. S., 410.
Whitcomb, W. O., 231, 831.
White, A. H., 286.
White, E. N., 492.
White, G. C., 784.
White, P. S., 674.
White, R. G., 372.
White, T. H., 332.
White, T. P., 787.
White, W. T., 426, 467.
Whitehead, T., 148, 443, 445.
Whiting, P. W., 453, 567.
Whitman, J. L., 203.
Whitson, A. R., 623.
Whittemore, M., 98.
Whitten, J. C., 104.
Whittet, J. N., 33.
Whittico, I. E., 695.
Whittier, B. B., 718.
Wiancko, A. T., 830.
Wickham, H. F., 652.
Wickson, E. J., 396, 438.
Wickware, A. B., 377.
Widdows, S. T., 765.
Wiegand, E. H., 388.
Wierzchowski, Z., 160.
Wiggans, C. C., 340.
Wiles, H. H., 123, 814.
Wiley, J. R., 864.
Wiley, R. C., 17.
Wilfrid, M., 171.
Wilkins, F. S., 230.
Willaman, J. J., 503, 856.
Willard, A. C., 288.
Willard, C. J., 849.
Williams, A., 390.
Williams, C. B. (Egypt), 51, 208, 450, 550.
Williams, C. B. (N. C.), 724, 733.
Williams, C. G., 395, 798.
Williams, F., 99.
Williams, F. E., 77.
Williams, G., 264.
Williams, H., 772.
Williams, H. E., 718.
Williams, J. D., 781.
Williams, O. E., 579.
Williams, R. H., 196.
Williams, S. E., 99.
Williams, W. B., 156.
Williamson, R. M., 509, 718.
Willis, J. C., 96.
Willis, L. G., 754.
Willis, M. A., 396.
Willis, R. L., 233.
Wills, H. M., 508.
Willson, C. A., 498, 709.
Willson, G. H., 508.
Willy, J., 57.
Wilmott, A. J., 423.
Wilson, B. D., 235.
Wilson, C. E., 352, 654.
Wilson, D. W., 714, 715.
Wilson, E. H., 43, 440, 836.
Wilson, G. S., 584, 585.
Wilson, H. F., 156, 653, 760.
Wilson, I. D., 900.
Wilson, J. K., 520.
Wilson, J. W., 599.
Wilson, M., 443, 446, 447.
Wilson, W. H., 391.
Wiltshire, S. P., 44, 45, 48, 50.
Windes, E. E., 597.
Wingard, S. A., 300, 545.
Winge, Ö., 770.
Winkler, A. J., 545.
Winkler, C. H., 199.
Winslow, C.-E. A., 591.
Winslow, E. A., 897.
Winter, A. R., 675.
Winter, L. B., 715.
Winters, N. E., 299.
Withrow, J. R., 408.
Witte, H., 225.
Witte, W. L., 397.
Wittmack, L., 232.
Wöber, A., 127.
Woglum, R. S., 849.
Wohlfarth, O., 493.
Wolbach, M. O., jr., 287.
Wolcott, G. N., 52, 56, 252, 549.
Wolf, F. A., 747.
Wolfe, T. K., 300.

Wolff, 380.
Wolfram, A., 252.
Woll, F. W., 275.
Wollenweber, 839.
Wollman, E., 666.
Wong, S. Y., 111, 118.
Wood, A. A., 848.
Wood, (Mrs.) I. C., 603.
Wood, J. H., 287.
Wood, L. S., 191.
Wood, T. B., 493.
Woodman, H. E., 264, 308, 781.
Woodruff, S., 660.
Woods, A. F., 799, 800.
Woods, W. C., 657.
Woodward, C. R., 492, 698.
Woodward, N. F., 430.
Woodward, T. E., 676.
Woodworth, C. M., 425.
Woodworth, H. E., 156.
Woolsey, T. S., jr., 238.
Wooster, R. S., 288.
Work, H., 705.
Working, E. B., 397, 697.
Works, G. A., 96, 194, 597.
Wormald, H., 147, 248, 250.
Wright, A. H., 630.
Wright, I., 594.
Wright, R. C., 743.
Wright, S., 368, 568.
Wright, W. J., 96.
Wülker, G., 50.
Wylie, D. C., 438.
Wyllie, J., 173.

Yagloglau, C. P., 688.
Yao, H. H., 317.
Yapp, C. R., 668.
Yates, J. W., 699, 700.
Yoder, P. A., 230.
Yoshida, S., 609, 610.
Yoshiue, S., 564, 566.
Yothers, M. A., 452.
Yothers, W. W., 654.
Young, G. A., 85.
Young, H., 275.
Young, H. C., 497.
Young, H. P., 692.
Young, J. B., 413.
Young, M. T., 156.
Young, R. A., 738.
Young, V. H., 98.
Young, W. J., 235.
Youngblood, B., 495.
Yu, C.-L., 611.
Yule, G. U., 577.
Yusope, M., 255.

Zapoleon, L. B., 794, 795.
Zappe, M. P., 534.
Zeasman, O. R., 285, 686.
Zebrowski, G., 80.
Zeisenheim, F. C., 387.
Zeitoun, M., 499.
Zeleny, C., 266, 567.
Zeller, H., 785.
Zeller, S. M., 755.
Zeman, V., 445.
Zielstorff, W., 205.
Zietzschmann, O., 173.
Zilva, S. S., 59, 562, 780, 806.
Zimmerley, H. H., 233.
Zinn, J., 231.
Zook, L. L., 527.
Zorn, 796.
Zsigmondy, 812.
Zubrilov, K. M., 780.
Zucker, T. F., 65, 608.

INDEX OF SUBJECTS.

NOTE.—The abbreviations "Ala.Col.," "Conn.State," "Mass.," etc., after entries refer to the publications of the respective State experiment stations; "Alaska," "Guam," "Hawaii," "P.R.," and "V.I." to those of the experiment stations in Alaska, Guam, Hawaii, Porto Rico, and Virgin Islands; "Can." to those of the experiment stations in Canada; and "U.S.D.A." to those of this Department.

Abortion—
agglutination reaction for, 586.
and diseases of foals, 481.
bacilli in blood of calves from infected milk, 681.
bacteria associated with, Ky., 581.
bovine, susceptibility of swine to, Mich., 884.
cause, Colo., 476; Kans., 478.
experimental, in a cow, 380.
immunization against, 881.
in cattle, 785; Conn.Storrs, 784.
in cattle, control, 179; Mich., 478; Mo., 79.
in cattle, papers on, Calif., 79.
in domestic animals, 477.
in mares, 283; Ky., 272, 273.
in swine, Ill., 380, 787.
methods of spread, Oreg., 582.
(*See also Bacillus abortus and Bacterium abortus.*)
Absidia ramosa rasti, notes, 381.
Absorptive power of soils, effect of pulverization and settlement, 512.
Acacias in Australia, 440.
Accessory food factors. (*See* Vitamins.)
Accounting, farm. (*See* Farm accounting.)
Acetic index, value in detection of butter adulteration, 311.
Acetone, use in composite engine fuels, 888.
Acid—
application to garden soil, effect on propagation, 836.
carbonate salts, buffer action, 814.
feeding, effect on pigs, Iowa, 772.
phosphate. (*See* Superphosphate.)
Acidity, specific, of foliage of African sorrell, 713.
Acids—
amino. (*See* Amino acids.)
determination in silage, 205, 206.
fatty. (*See* Fatty acids.)
in fruit juices and foods, determination, 805.
inorganic and organic, titration, 803.
organic and inorganic, adsorption by activated sugar charcoal, 506.
Acids—Continued.
organic, in preserved fruits, 112.
rôle in jelly formation, Del., 9.
volatile, produced by starters, Iowa, 781.
Aconitum columbianum, chemical examination, Wyo., 476.
Acrostalagmus vilmorinii thomensis, notes, 540.
Actinomyces, activity in soils, 515.
Actinomyces—
chromogenus, control, Va.Truck, 348.
chromogenus, notes, 843.
scabies, notes, 46.
Actinomycetes, morphology and biology, 30.
Actinomycosis, bovine, causal organisms, 380.
Adlay food characteristics, 56.
Adrenal glands, function, relation to H-ion concentration, 561.
Adrenalin, effect on deficiency disease in pigeons, 769.
Adsorption—
by activated sugar charcoal, 505.
of plant food by soil colloids, 17.
Advertising and farm market, papers on, 190.
Aedes aegypti, notes, 657.
Aedes calopus (*Stegomyia*) larvae, time of exposure to kerosene, 853.
Aegeria exitiosa. (*See* Peach borer.)
Aegeria tipuliformis. (*See* Currant borer.)
Aeration, effect on Azotobacter, 213.
Aerology. (*See* Air and Atmosphere.)
Afforestation. (*See* Forestation.)
Agamermis decaudata n.g. and n.sp., studies, 357.
Agglutination—
studies of *Clostridium* spp., 881.
test, technique for diagnosing abortion, 586.
tests on sera prepared with *Bacillus sporogenes,* 880.
Agglutinins in milk, source, 280.
Agglutinins production, effect of vitamin deficiency, 279.
Aggregates, road. (*See* Road materials.)
Agrarian problem in Hungary, 894.

Agricultural—
analysis, quantitative, manual, 407.
bacteriology, textbook, 819.
business management, 89.
chemistry. (*See* Chemistry.)
college—
determining aims of courses, 596.
education, California view, 301.
problem of research in, 596.
teachers and teaching, papers on, 596.
colleges—
curricula, papers on, 492.
extension activities, 796.
laws concerning, U.S.D.A., 195.
list of workers in agriculture, U.S.D.A., 492.
(*See also* Alabama, Arizona, *etc.*)
colonies and tenancy copartnership societies in Burma, 389.
commodities, prices, index to sources of, U.S.D.A., 794.
conditions in—
French Alps, 390.
Kalamazoo Co., Mich., 898.
Morocco, 595.
Russia, 693.
Saskatchewan, 894.
(*See also* Agriculture.)
cooperation in—
Belgium, 895.
Denmark, 190.
India, 191.
India, treatise, 93.
Russia, revival, 191.
cooperative—
associations, statistics, Minn., 490.
movement, treatise, 391.
societies in Sweden, 894.
syndicates in France, 894.
credit in Great Britain, 891.
Credits Act of 1923, 292.
curriculums, building, interpreting local practices in, 493.
department of a country bank, treatise, 295.
development in India, trend, 295.
economics. (*See* Rural economics.)
education, 597.
education—
and research in China and Japan, 596.
and research in Czechoslovakia, 596.
fundamentals, 392.
in Algeria, 796.
in Canada, 100.
in Denmark, 897.
in England and Wales, 393.
in India, 194.
in Norway, 896.
professional, for farm children in Belgium, 95.
project method in, 194.
public professional, 598.
relation to farm organization, U.S.D.A., 392.
Agricultural—Continued.
education—continued.
relation to Federal Government, 7.
(*See also* Agricultural Colleges, Agricultural instruction, Agricultural schools, *etc.*)
education, vocational—
equipment for, in secondary schools, 95.
for colored students, 194.
in secondary schools, 895.
treatise, 493.
engineering. (*See* Engineering.)
experiment stations. (*See* Experiment stations.)
experimentation, application of probable error, 596.
extension—
activities of Guam Station, Guam, 494.
clubs, junior, organization, 297.
junior, 96.
method of measuring, 596.
plans of United States Department of Agriculture, 491.
extension program—
building, 492.
determining, function of research departments, 596.
in rural social organization, 492.
extension—
publications, Mich., 495.
service in economics, 492.
specialist, field of, 596.
work, achievement, 195.
work, junior, community plan, 297.
workers, education for, 492.
workers, training, 596.
facts and figures, notebook, 193.
fair exhibits, West.Wash., 898.
holdings in France, consolidation, 189.
income, course from 1897 to 1922, 290.
institute at University of Breslau, 796.
Institute of Algeria, 796.
institutions, changes in leadership, 1.
Instruction Act in Canada, report, 896.
instruction—
in Cuba, 696.
in New Zealand, 95.
planning the course with the farmer, 797.
(*See also* Agricultural education.)
journals, new, 400, 499.
labor—
and equipment, cost data, N.Y. Cornell, 691.
in England, 189.
requirement in Ohio, 189.
supply, maintenance during the war, 692.
treatise, 191.
(*See also* Labor.)
machinery—
and implements, studies, 85.
for thinning and harvesting root crops, 86.

Agricultural—Continued.
machinery—continued.
high-speed rotating, balancing, 485.
tests, 486.
uses of ball and roller bearings, 589.
(*See also* Thresher.)
meteorology, field of investigation, 807.
mills, cooperative, 94.
nature study, course of instruction in, Calif., 195.
Organization Society, report, 93.
output, controlling, 89.
possibilities in Pahang, Federated Malay States, 895.
products—
cost of production. (*See specific crops.*)
marketing. (*See* Marketing.)
of France, foreign trade, 296.
of international importance, 94.
plan to fix prices by Government control of surplus, 489.
prices, farmers' influence on, 91.
prices in New York, N.Y.Cornell, 92.
profits and taxes in France, 892.
questions, technical survey, 487.
research—
administration, 707.
in Canada, 100.
papers on, 596.
promoting high standards in, 492.
relation to Federal Government, 7.
relation to public welfare, 492.
worker, environment, 596.
resources of Manchuria, 694.
schools in China, 796.
staples and the tariff, 794.
station administration, human problem in, 596.
statistics, U.S.D.A., 391.
statistics of—
Arizona, 392.
Chile, 895.
Colorado, 392.
Connecticut, 392.
Denmark, 895.
England and Wales, 895.
exports and imports, summary, U.S.D.A., 391.
France, 296.
Latvia, 296.
Morocco, 895.
Netherlands, 296.
New South Wales, 93.
New Zealand, 392.
Union of South Africa, 193.
students, boarding, supervised practical work for, 297.
survey, charts and maps, 491.
survey in Manitoba, report, 491.
teachers, training in Cuba, 696.
tenancy. (*See* Land holdings, Land tenancy, *and* Land tenure.)
tools, average accomplishment, 189.
tribunal of investigation, 388.
Agricultural—Continued.
village in Russia, life in, 694.
wages payment, development, 692.
Agriculture—
administration of bureaus in Philippines, 193.
an advertising opportunity, 190.
and home economics, cooperative extension, U.S.D.A., 494.
and the International Labor Organization, 693.
and war, 595.
degree of bachelor of, 500.
Department of. (*See* United States Department of Agriculture.)
French, and socialism, 594.
graduate instruction in Canada, 796.
in Algeria, 295, 895.
in America, beginnings, treatise, 191.
in Austria, U.S.D.A., 93.
in cut-over redwood lands, Calif., 90.
in Denmark, 190.
in Georgia, development, 92.
in Hungary, 894.
in New South Wales, 93.
in Northern Africa, future, 595.
in Norway, 896.
in Portugal, potentiality, 93.
in Russia, activity of People's Commissariat, 292.
in Saar region, 389.
in Shan State, taungya cultivation, 322.
in Switzerland, 389.
in Tropics, treatise, 96.
in Wisconsin, history, 794.
(*See also* Agricultural conditions.)
on large farms southeast of Paris, 894.
relation to population, 568.
rôle in life of nation, 191.
rôle of plant pathology in, 240.
situation in world, and European consumption, 596.
tropical and subtropical, 493.
tropical, West-Indian College of, 95.
uses of gypsum in, 124.
Agrilus ruficollis, studies, Wis., 654.
Agrilus spp., biology, 848.
Agrotis ypsilon. (*See* Cutworm, black.)
Air—
and its ways, treatise, 614.
of Sao Paulo, analysis, 413.
soil, rôle in hydrophytic habitats, 29.
space, insulating properties, 187.
temperature, weekly average, Ky., 509.
upper, spores in, 747.
(*See also* Atmosphere.)
Airplane—
use in dusting trees, 654.
use in forest insect control, Ohio, 352.
use in forest patrol work, 838.
use in soil survey work, 616.
woods, decay and discolorations in, U.S.D.A., 351.
Alabama argillacea, control, V.I., 352.
Alabama College, notes, 697.
Alabama Station, notes, 697.

Alabama, Tuskegee Station, notes, 496.
Alaska College, notes, 299.
Alaska Stations, report, 494.
Albumin, egg—
cystin and noncystin sulphur in, 503.
new sulphur-containing amino acid from, 714.
Alcohol—
absolute, preparation, 114.
ether mixtures, determination of ether in, 114.
fuel in England, sources, 185.
fuels for internal-combustion engines, 590.
motor fuel, manufacture from waste molasses, 387.
motor fuel, production and utilization, treatise, 286.
test for grading milk, 716.
(*See also* Ethyl alcohol.)
Alcoholic treatment of white rats, 567.
Alcohols, denatured, for fat extraction test, Wis., 611.
Alfalfa—
as affected by inoculation, Ariz., 620.
as affected by pH value, 825.
as protein supplement for pigs, Mich., 469.
brown hay, loss of crude and digestible nutrients in, 669.
campaigns, county, Mich., 97.
crown gall, biology, 146.
culture, 329; Ky., 525; Wis., 31, 630.
culture experiments, Alaska, 426; Can., 734; Mont., 430; Okla., 414; Tex., 429.
cutting trials, Wis., 630.
distance-of-cultivation test, Mont., 130.
effect on following crop, Mont., 129; Nebr., 733.
feeding value, Wyo., 867.
fertilizer experiments, 31, 329; Ga., 524; Kans., 427; Miss., 428; N. Mex., 517.
hard seed, tests, Colo., 441.
hay, as affected by gypsum, 727.
hay, feeding value, 874; N. Mex., 868, 869; Okla., 467.
hay, methods of handling, Colo., 86.
LeBeau, Mich., 31.
Peronospora attacking, 542.
quality as affected by fertilizers, Mich., 431.
returns from, in Georgia, 90.
rotation experiments, Oreg., 526; Wyo., 429.
seed production, Mont., 430.
seed scarification, effect on longevity, 130.
seeding experiments, 225; Can., 734; Idaho, 736; Mont., 430.
stomatal behavior in, 422.
thrips, effect on alfalfa seed production, 850.
time of cutting tests, Wash.Col., 224.
v. clover hay for heifers, Ohio, 375.
value in rotations, Nebr., 328.
varieties, yields, Pa., 223.
Alfalfa—Continued.
variety tests, Alaska, 426; Can., 734; Idaho, 732; Miss., 428; N.Mex., 525; Oreg., 526; Tex., 429; Va., 134; Wash.Col., 224.
weevil parasite, value, Idaho, 756.
winterkilling, Wis., 631.
yield, factors affecting, Mont., 430.
Algae and nitrogen-fixing bacteria, symbiosis, 117.
Algal cells, methods of healing in, 522.
Alkali—
black, anhydrite as remedy for, 124.
content of soils as related to crop growth, 513.
salts as affected by irrigation and drainage, N.Mex., 886.
salts, toxicity and antagonism in soil, 620.
(*See also* Sodium salts.)
soil, black, oxidation of sulphur in, 625.
soil, black, treatment, Calif., 320.
soils of Newlands project, U.S.D.A., 621.
soils, reclamation experiments, U.S.D.A., 621.
studies, N.Mex., 513.
vertical movement under irrigation, 513.
Alkaline earths, effect on determination of reducing sugars, 715.
Allergins due to *Bacterium pullorum* and to *Bacterium sanguinarium*, 886.
Almond roostock, identification, Calif., 637.
Almonds—
culture experiments, N.Mex., 532.
spraying experiments, Calif., 53.
Alsophila pometaria. (See Cankerworm, fall.)
Alternaria sp., notes, Ga., 346.
Alternaria tenuis, notes, 548.
Alternaria spores in the upper air, 747.
Aluminum—
active, in acid soils, 804.
effect on corn, 327, 519.
Amaranthus retroflexus germination, effect of temperature, 522.
Ameloctonus spp., studies, 555.
American—
Association of—
Agricultural College Editors, 200.
Medical Milk Commissions, 175.
Soil Survey Workers, proceedings, 616.
Society of Animal Production, proceedings, 863.
Amino acid and carbohydrate relation in respiration of leaves, 728.
Amino acid, new sulphur containing, 714.
Amino acids, methods of determining, 715.
Amino acids, synthesis in animal organisms, 661.
Amino nitrogen, determination, 714.
Amino nitrogen, free, in proteins, 715.
Ammonia—
absorbent power of soils for, 515.
excretion in hunger osteopathy, 159.

Ammonia—Continued.
in urine, determination, 806.
industrial transformation into urea, 517.
nitrogen, leaching from soils, 419.
phosphoric acid, and potash, proportions for fertility, Ohio, 323.
Ammonification—
as affected by gypsum, 727.
in soils, studies, 723.
Ammonium—
bicarbonate, fertilizing value, 19.
chlorid, fertilizing value, 20, 623, 825.
compounds, nitrogen content, method of determining, 717.
Ammonium sulphate—
effect on barley, 631.
effect on pineapples, Guam, 435.
fertilizing value, 20, 623, 815, 834; Guam, 427.
nitrate, fertilizing value, 20, 623.
nitrification, effect of lime and chalk, 512.
summary, 123.
toxic effect, 517.
Amorphoidea lata, notes, 156.
Amylases, hydrolysis of starch by, factors affecting, 10.
Anabrus simplex, control, Colo., 450.
Anaerobes—
heat resistance, 863.
toxin-producing, from fly larvae, 255.
Anaerobiosis, securing with hydrogen, 863.
Anarsia lineatella. (*See* Peach twig-moth.)
Anasa tristis. (*See* Squash-bug.)
Anatidae, North American, life histories, 756.
Anemia, infectious equine—
incubation period and course, 787.
virus, resistance to carbolic acid, 684.
Anesthesia, local, paper on, 178.
Anhydrite, use on black alkali soils, 124.
Anhydrous copper sulphate and lime, fungicidal value, 645.
Animal—
breeding—
new standards in Germany, 165.
sterility in relation to, Ky., 164.
(*See also* Hybridization *and specific animals.*)
chromosomes. (*See* Chromosomes.)
diseases—
and bacteriology, treatise, 177.
caused by parasites, 177.
control, 178.
in Canada, 377.
in England, 178.
in Gold Coast, 278.
in Hawaii, 378.
in Ireland, 278.
in Kentucky, Ky., 580.
in Michigan, 278.
in Tasmania, 179.
laboratory and field diagnosis, Ky., 581.
treatise, 278.
(*See also specific diseases.*)
Animal—Continued.
feces, detection of worm eggs in, 785.
husbandry extension round table, 864.
husbandry, instruction in, 96.
husbandry, teaching, problems, 864.
Nutrition Institute of University of Cambridge, 493.
nutrition, potassium in, 568.
parasites, diseases caused by, 177.
parasites, treatise, 377.
pests, control in Oregon, 756.
pests in Switzerland, 144.
pests of orchard, gardens, and ornamentals, treatise, 654.
tissue, lead determination in, 113, 114.
tissues, iron detection in, 408.
Animals—
and their environment, treatise, 756.
digestion experiments, errors in, 865.
domestic—
blood transfusion in, 178.
care, treatise, 377.
comparative anatomy, treatise, 278.
growth in, 164.
in Italy, 67.
draft, working conditions, 570.
farm work, feeding, 69.
laboratory, epidemics among, 584.
marine, lunar periodicity in, 115.
marine, zinc and copper in, 258.
newborn, respiratory exchange in, 15.
slaughterhouse, parasites of, La., 283.
types, differentiating, Wis., 668.
young, diseases, treatise, 782.
young, hygiene and nutrition, 772.
(*See also* Cattle, Livestock, Mammals, Sheep, *etc.*)
Anisopteryx sp., control by airplane, 654.
Anopheles, distribution in Bavaria, 50.
Anopheles in rice fields, control, 50.
(*See also* Mosquitoes.)
Anopheline larvae, arsenic as larvicide, 55.
Anseres, North American, life histories, 756.
Anthelmintics, methods of administering, 788.
Antheraea spp., diseases of, 154.
Anthocyan formation in plants, 26.
Anthonomus—
cinctus, notes, 255.
grandis. (*See* Cotton boll weevil.)
grandis thurberiae, distribution, Ariz., 558.
signatus. (*See* Strawberry weevil.)
Anthracnose, notes, Oreg., 546.
(*See also specific host plants.*)
Anthrax—
bacilli, intracutaneous inoculation, 881.
control, 179.
notes, 278.
resistance, effect of vitamin deficiency, 279.
symptomatic. (*See* Blackleg.)
transmission by insects, La., 881.

Anthrax lateralis, notes, 657.
Antianthe expansa, notes, 550.
Antimony—
electrode, use for titration of acids and bases, 803.
toxic action on plants, 127.
Antineuritic vitamin. (*See* Vitamin.)
Antirrhinum spp., propagating in acid medium, 836.
Antiscorbutic. (*See* Scurvy.)
Antiscorbutic vitamin. (*See* Vitamin C.)
Antixerophthalmic vitamin. (*See* Vitamin A.)
Ants, Argentine, control, La., 52.
Ants, control, Conn.State, 660.
Ants, treatise, 453.
Ants, white. (*See* Termites.)
Apanteles hyphantriae, studies, 555.
Aphididae, alate forms in, occurrence, 50.
Aphidiinae, life history, 559.
Aphidius spp., larval stages, 559.
Aphids—
as carriers of potato diseases, 752.
in Porto Rico, enemies and control, 52.
parasites of, 559.
penetration of plant tissues and food supply, 153.
studies, Ohio, 352.
woolly, control, Md., 354.
woolly, immunity of apple stocks, 655.
woolly, movement from elm to apple, 451.
woolly, studies, 451.
(*See also* Apple aphis, woolly.)
Aphis—
brassicae. (*See* Cabbage aphid.)
gossypii. (*See* Cotton aphid and Melon aphid.)
maidis, transmission of sugar-cane mosaic by, 52.
pomi, development, 353.
rumicis, biological studies, 153.
rumicis, test of insecticides for, U.S.D.A., 550.
Apiaries, inspection in Kansas, 251.
Apiculture. (*See* Beekeeping.)
Apis fasciata, notes, 660.
Aplastomorpha vandinei, studies, 256.
Apparatus for—
determining dissolved carbon dioxid, 505.
determining H-ion concentration, N.Y. Cornell, 712.
dispensing concentrated sulphuric acid and sodium hydroxid, 504.
electrometric titration of sugars, 203.
measuring radioactivity of fertilizers, 217.
measuring respiratory exchange in new-born animals, 14.
preparing absolute alcohol, 114.
testing gelatin, 879.
titration of acids and bases, 803.
Apparatus—
viscometer, 110.
Zuntz-Geppert, for respiration experiments, 863.
Apple—
and thorn skeletonizer—
rapid spread of, 356.
studies, Conn. State, 556.
anthracnose, control, Oreg., 538; West.Wash., 845.
aphis, woolly, habits in Virginia, 451. (*See also* Aphids, woolly.)
bark canker disease, 44.
beverage, preparation, Calif., 412.
black spot, control, 546.
blotch control, Ind., 545; Ohio, 338; Okla., 445.
blotch, infection by, Ind., 538.
blotch, summary, Ind., 754.
blue mold, notes, 49.
bud aphis, notes, Iowa, 757.
bud-moth, new, in Pennsylvania, 656.
bud weevil, notes, 255.
by-products as stock foods, U.S.D.A., 675.
canker control, 48.
canker, European, control, Oreg., 539.
canker, studies, 44.
crown gall, notes, Iowa, 747.
cuttings, stimulation of bud growth, 834.
diseases, parasitic, 1915–1920, 445.
fire blight, notes, 442, 445.
flea weevil, outbreak, 855.
fruit spot, new, Ohio, 648.
fruit spots, notes, 442.
leaf roller, control, Pa., 251.
leaf tissue, catalase activity in, N.Y. Cornell, 28.
leafhopper, control, 654.
maggot, control, N.H., 352.
maggot, summary, Me., 657.
measles, N.Mex., 546.
nursery stock, control of woolly aphid in, 451.
orchards, fertilization, N.Y.State, 534, 535.
orchards, management, Ind., 531.
pectin extracts, homemade, use, U.S.D.A., 114.
pectin pulp, analyses and manufacture, U.S.D.A., 675.
pollen germination studies, 437.
pomace, analyses and manufacture, U.S.D.A., 675.
pomace silage. (*See* Silage.)
refuse in soil, effect on nitrogen fixation, 18.
root rot, notes, 445.
roots, winter injury to, N.H., 327.
rosette, Wash.Col., 248, 755.
rust, notes, 442.
scab, control, 44; Ind., 531; Mich., 48; N.H., 350; Ohio, 338; Wis., 644.
scab, notes, 442, 445.
scald, notes, 49.
season, northwestern, U.S.D.A., 90.
seedlings—
effect of parentage, Iowa, 740.
quality as affected by quality in parents, Idaho, 739.

Apple—Continued.
seeds, afterripening and germination, 27.
silver-leaf, notes, 845.
spurs, blooming performance, N.H., 336.
stocks, resistance to woolly aphis, 655.
storage house, description, Mich., 890.
sucker, control, 758.
sucker, European, studies, 850.
sucker, summary, 153.
tree crotch, histological studies and practical considerations, N.Y.Cornell, 639.
trees—
composition, effect of shading and ringing, N.H., 741.
effect of fertilizers on, 617.
effect of sod in relation to moisture and nitrates, N.Y.Cornell, 235.
fertilizer experiments, Iowa, 740.
young nursery, carbohydrate reserves as affected by winter storage, 138.
worm, amount of arsenic for, 656.
Apples—
air cooled storages for, Mich., 889.
apical browning, 45.
breeding experiments, S.Dak., 533.
bud-selection study, N.Y.State, 38.
calyx spray, formula, Conn.State, 742.
canned in enameled cans, varying amounts of oxygen in, 856.
cold-storage holdings, U.S.D.A., 893.
cover crops for, Mont., 136.
crab. (*See* Crab apples.)
culture experiments, Alaska, 435.
dusting experiments, N.Y.State, 39.
dusting v. spraying, Conn.State, 534.
early blooming and low production, U.S.D.A., 636.
hardy, ascertaining degree of hardiness, Iowa, 740.
insects affecting in South Dakota, 448.
new or noteworthy, N.Y.State, 338.
pollination experiments, Ohio, 339.
pollination studies, Iowa, 39.
pot-grown, fertilizer experiments, 883.
propagation studies, Iowa, 740.
pruning experiments, Ind., 531; Ky., 531; N.Y.Cornell, 637; N.Y.State, 339, 742; Ohio, 337.
pruning, modified leader, Wis., 639.
relation of pruning to fruit bearing, N.Y.Cornell, 638.
results of propagation methods, N.Y. State, 38.
ringing experiments, 138.
root development, 38.
secondary flowering, 834.
self-sterility and cross-incompatability in, 234.
spoilage after harvest, 49.
spray schedules for, N.J., 138.
Apples—Continued.
spraying experiments, N.J., 349; N.Mex., 154; N.Y.State, 39; Ohio, 338, 350; West.Wash., 845; Wis., 644.
spreader tests on, 353.
sterility relationships in, Me., 139.
storage experiments, 39.
thinning tests, Calif., 235; Mont., 136.
tillage experiments, Mont., 136.
time of fruit bud differentiation, 834.
time of harvest studies, Oreg., 553; Wash.Col., 232.
varieties, Mont., 136.
varieties, detecting, 139.
variety tests, N.H., 336.
Whitney, breeding experiments, 139.
Yellow Newtown, internal browning of, studies, 545.
Apricot—
diseases, parasitic, 1915–1920, 445.
root-stock, identification, Calif., 637.
Apricots—
nickel and cobalt in, 520.
spraying experiments, Calif., 53.
thinning, Calif., 235.
Aquatic caterpillar of *Nymphula* sp., 53.
Arachidic acids, determination method, 611.
Arachnids of Pribilof Islands, U.S.D.A., 652.
Araucaria cultivated in South Africa, 342.
Arbor Day, U.S.D.A., 641.
Arbor Lodge, gift to Nebraska, 500.
Archips argyrospila—
control, Mont., 251.
summary of information, Mont., 254.
Arenaria hookeri, chemical examination, Wyo., 476.
Argas spp., notes, 157.
Argasidae in Punjab, 157.
Arisaema, control of sexual state in, 523.
Aristida longiseta, mechanical injury to livestock from, 679.
Arizona Station, notes, 196, 396, 697.
Arizona University, notes, 196, 396, 697.
Arkansas—
Station, notes, 98.
University, College of Agriculture, facts about, Ark., 297.
University, notes, 98, 396.
Armadillo, trypanosome infestation, 180.
Armillaria mellea as potato disease, 443.
Armillaria sp., notes, 540.
Army worm—
control, 448.
fall, control, V.I., 352.
meteorological relations, Minn., 759.
notes, 758.
Arsenates—
effect of soap on injury due to, 750.
preparation, U.S.D.A., 448.
Arsenic—
as anopheline larvicide, 55.
toxic action on plants, 127.
white, use in Bordeaux mixture, 50.

Arsenical—
compounds for blackhead, 382.
spray for codling moth control, 759.
Arsenicals—
injury to foliage by, 750.
properties, U.S.D.A.,, 448.
toxicities, U.S.D.A., 449.
viticulture, and plant protection, paper on, 50.
white, coloring for stock dipping, 378.
(*See also* Calcium arsenate, Lead arsenate, *and* Sodium arsenite.)
Arsenite of soda as locust poison, 450.
Arsenites, preparation, U.S.D.A., 448.
Arsenites, toxicities, U.S.D.A., 449.
Arsphenamin, parasiticidal value, factors affecting, 479.
Artichokes, culture in Sicily, 37.
Artichokes, triple infection of, 45.
Arts, related, course for high schools, 798.
Arvelius albopunctatus, control, V.I., 353.
Ascarapis woodi, protection against introduction into America, 357.
Ascaridia galli, treatment for, 684.
Ascarids, control, 77.
Ascaris—
columnaris, morphology and life history, 499.
megalocephala, embryonated eggs, feeding effects, 179.
vitolorum extracts, effects on experimental animals, 76.
Ascochyta cynarae, notes, 45.
Ash—
constituents in body tissues on various diets, 564.
determination in sugar and molasses, 505.
determination in sugar, methods, 408.
seeds, delayed germination, 141.
Ashes, wood. (*See* Wood ashes.)
Asparagus—
fertilizer experiments, R.I., 533.
variety tests, Mont., 136.
Aspergillus—
delacroixii, notes, 540.
glaucus-repens, notes, 263.
Aspergillus niger—
sources of sulphur for, 26.
spore, germination, effect of acidity, 125.
utilization of organic substances by, 126.
Aspergillus spp., growth inhibiting factors, Iowa, 722.
Aspergillus growth, effect of metal salts, 27.
Aspidiotus perniciosus. (*See* San José scale.)
Assimilation by submerged plants, 423.
Association of Land Grant Colleges—
editorial, 701.
officers, 799.
proceedings, 491, 596.
Atmosphere, water vapor in, 15.
(*See also* Air.)
Atmospheric circulation, treatise, 614.
Atmospheric moisture. (*See* Humidity.)
Atropin, effect on deficiency disease in pigeons, 769.
Attacus ricini, notes, 154.
Aucuba japonica cuttings as affected by carbon dioxid, 836.
Auloicerya, new genus, erection, 851.
Automobile, gasoline, treatise, 85.
Autopsies, paper on, 178.
Avena spp., as weed pest in Russia, 37.
Avitaminosis—
as affected by histamin, 261.
carbohydrate metabolism in, 565.
course of, effect of function, 566.
enzymic activity of digestive apparatus in, 161.
experiments with chicks and ducks, 64.
in fishes, 565.
Avocados, pollination, 237.
Avocados, types in Porto Rico, 341.
Azotobacter agile, studies, 18.
Azotobacter chroococcum, volutin in, 731.
Azotobacter—
as source of Vitamin B, 364.
content of soil, effect of changing reaction, 619.
flora as affected by absolute reaction of soil, 813.
growth and nitrogen-fixing ability, effect of pH, 722.
growth, stimulating by aeration, 213.
life history, 221.
protein synthesis by, 626.
Babesiosis of dromedary, treatment, 400.
Baby beef. (*See* Cattle, baby beef.)
Bacillus abortus—
and *Micrococcus melitensis,* relationship, 881.
behavior, Kans., 478.
growth as affected by culture media, Okla., 477.
(*See also Bacterium abortus and* Abortion.)
Bacillus acidophilus—
nature of action, 363.
notes, 561.
Bacillus—
aerogenes, notes, R.I., 81.
aertrycke, virulence and host susceptibility, 882.
atrosepticus, notes, 46.
avisepticus, relation between types, 381.
Bacillus botulinus—
distribution in United States, 861.
in Alaska and Canada, 862.
in canned spinach, 163.
in Hawaiian Islands and China, 862.
in Santa Barbara Co., Calif., 861.
in soils and foods, enrichment and demonstration, 860.
in Western Europe, 862.
pathogenicity, 862.
spores, heat resistance, 162, 863.
spores in California, distribution, 860.
strains, relationship, 255.
types, Ill., 366.
under household conditions, 567.

Bacillus—
carotovorus, studies, 651.
caulivorus, notes, 45.
cloacae, notes, R.I., 81.
coli communis, notes, 201.
coli, notes, Ky., 581; R.I., 81.
enteritidis—
spread of infection, 584, 585.
virulence and host susceptibility, 882.
flavigena, notes, 201.
larvae, control, Wis., 653.
larvae, effect of sodium hypochlorite on, 156.
melitensis. (*See Bacterium melitensis and Micrococcus melitensis.*)
necrophorus, notes, Wis., 681.
(*See also* Necrobacillosis.)
ovisepticus, notes, 682.
paratyphosus B, virulence and host susceptibility, 882.
pestis caviae, virulence and host susceptibility, 882.
phytophthorus, viability, Nebr., 751.
radicicola. (*See* Nodule bacteria.)
septicaemiae, notes, R.I., 81.
solanacearum, new host plants, 144.
solanacearum, notes, 149.
solanisaprus, notes, 46.
sporogenes, heat resistance of, 163.
sporogenes, serologic agglutination, 880.
suipestifer, mutation among, 884.
(*See also Bacterium suipestifer.*)
tetani in soil and on vegetables, 863.
truffauti n.sp., description, 213.
viscosum equi, notes, Ky., 581.

Bacon curing, English methods, 470.
Bacon curing on the farm, 272.
Bacon production, value of first cross in, 170.

Bacteria—
anaerobic. (*See* Anaerobes.)
butyric acid-forming, in Swiss cheese, 679.
gram staining, procedure, N.Y.State, 731.
in milk, soil, etc. (*See* Milk, Soils, *etc.*)
intestinal, factors controlling, 561.
life cycles, 221.
reaction to chemical treatment, 818.
sulphur-oxidizing, action in alkali soil, 625.

Bacterial—
count, determining, technique, 309.
infection, relation to vitamin C, 461.
infection, spread, 584, 585.
metabolism, studies, 609, 610.

Bacteriology—
agricultural, textbook, 819.
and animal diseases, treatise, 177.
textbook, 125, 625.

Bacteriolysins, production, effect of vitamin deficiency, 279.
Bacteriosis, studies, 651.

Bacterium—
abortum—
importance in abortion, Calif., 79.
in swine and rabbits, 477.
abortus—
equi, notes, 283.
paths of infection, 179.
(*See also Bacillus abortus and* Abortion.)
angulatum, description and control, 647.
angulatum, notes, 545.
aracoli, notes, R.I., 81.
citri. (*See* Citrus canker.)
coli communis in poultry, 482.
(*See also Bacillus coli communis.*)
flaccumfaciens, notes, 751.
gallinarum, notes, R.I., 81.
melitensis, notes, 380.
(*See also Micrococcus melitensis.*)
melleum n.sp., studies, 248.
paratyphi abortus equi, notes, 481.
pelargoni n.sp., proposed name, 250.
prodigiosum, notes, 151.
puttemansi n.sp., notes, 545.
radicicola. (*See* Nodule bacteria.)
solanacearum, notes, 149.
suipestifer, notes, R.I., 81.
(*See also Bacillus suipestifer.*)
tabacum, description and control, 647.
tabacum, notes, 545; Fla., 838; Wis., 643.
tularense, cultivation, amino-acid cystin in, 784.
tularense, cultivation on new media, 455.
tumefaciens, notes, 820.
vascularum, notes, 539.
vignae, n.sp., description, 246.

Baking—
club manual, Ill., 494.
technology, laboratory manual, 114.
Balsam fir, dying, in Minnesota, 254.
Bamboo, new chalcid attacking, 255.
Banana—
aphid, notes, 451.
bunchy top, notes, 150.
disease in Dutch East Indies, 149.
flower bud, vitamin C in, 563.
root-borer, notes, 550.
stems, fiber value, 329.
Bananas, respiration, nature of, 56.
Bandelier National Monument, interesting features, U.S.D.A., 342.
Bank agricultural department, treatise, 295.
Bankers' advances against produce, 390.
Barberry, destruction with chemicals, U.S.D.A., 146.
Barberry, eradication for wheat rust control, Mont., 146; U.S.D.A., 146.
Barges, insulated and refrigerator for perishable foods, 889.
Barium in Hagerstown soil, 617.
Barley—
absorption of water and nitrates, 29.
as affected by neutral phosphate, 517.

Barley—Continued.
as affected by potash, 817.
as affected by weather, 115.
breeding experiments, 329; Idaho, 732.
brewing value, relation to nitrogenous matter in, 31.
covered smut, control, 646.
culture experiments, Tex., 429.
culture experiments on citrus soil, 516.
culture in Morocco, 595.
fertilizer experiments, 20, 631.
genetic studies, 528.
hay yields, Mont., 430.
hulls, digestibility as affected by sodium hydrate, 167.
inheritance of awns and hoods in, 130.
kernels, water content, 219.
leaf rust, life cycle, Ind., 538.
leaf stripe and spot, control, 840.
leaf stripe, control, 145.
leaf stripe, tests of treatments, 840.
manuring experiments, Can., 734.
production in United States, statistical study, U.S.D.A., 389.
production, trade, and foreign competition in, 794.
protein composition, factors affecting, 821.
seed, treatment, Wis., 643.
seeding experiments, Can., 734.
smut, treatment, Okla., 542.
straw, hydrolyzed, composition and feeding value, 166.
varieties, Ga., 524.
varieties, descriptions, U.S.D.A., 825.
variety tests, 31. 232; Alaska, 426; Can., 734; Idaho, 732; Mont., 129; N.Mex., 525; Ohio, 733; Okla., 428; Pa., 223; Tex., 429; U.S.D.A., 825; Wash.Col., 224; Wyo., 429.
yields, Mont., 130; Pa., 223.
Barn roofs, self-supporting, tests, 890.
Barns, Dutch, and covered yards, designs, 287.
Barns, small, plans, Wash.Col., 689.
Basic slag. (*See* Phosphatic slag.)
Bathyplectes curculionis, value, Idaho, 756.
Bayer 205, for dourine control, 179.
Bayer 205, trypanocidal effect, 680.
Bean—
anthracnose, control, N.H., 345.
beetle, Mexican—
notes, Ky., 549.
search for parasites for, 761.
studies, N.Mex., 553.
beetle, new parasitic fly from, 453.
leaf beetle, control, N.C., 757.
mosaic disease, protozoa with, Mich., 45.
rust, susceptible varieties, Colo., 441.
seed disinfection tests, 841.
seed, home-grown, value, Mont., 136.
seeds, iron and manganese content, 202.
straw mulching, value for citrus, 835.
weevil, 4-spotted, parasite of, 256.
Bean—Continued.
weevil, treatment, Mich., 898.
wilt, effect of moisture, 751.
Beans—
absorption of hydrocyanic acid by, U.S.D.A., 457.
as affected by potash, 817.
breeding experiments, Can., 734.
bush and pole, studies, 841.
culture, Mont., 136.
culture experiments, Can., 734.
fertilizer experiments, N.H., 336.
for 1923, Mich., 97.
garden, rate of planting, 137.
improved Robust, Mich., 32.
inheritance in, 822.
Lima, effect of borax, U.S.D.A., 324.
mulching experiments, Ohio, 337.
nickel and cobalt in, 520.
pole, in drills with corn, varieties, R.I., 526.
small-seeded horse, characteristics and uses, Calif., 228.
snap, effect of borax, U.S.D.A., 324.
variety tests, Can., 734; Guam, 426; Tex., 429.
(*See also* Mungo *and* Velvet beans.)
Beaver farming, 250.
Beech nuts, germination, 536.
Beech woods, British, ecology, 536.
Beef—
autolysis, 11.
cold-storage holdings, U.S.D.A., 893.
cost of production, Ind., 592.
muscle, creatin content, 613.
production, sunflower silage v. corn silage for, Wash.Col., 268.
scrap, tankage as substitute, Can., 70.
trade, British imports, 296.
(*See also* Cattle, beef.)
Beekeeping—
education in, 251.
for beginners, 255.
handbook, 660.
in Canada, Can., 855.
in Oregon, 762.
in tropical colonies, 762.
instruction in, 96.
research work by Texas Station, 357.
summary of information, 762.
treatise, 762.
Bees—
beginning with, West.Wash., 97.
body temperatures, 659.
breeding experiments, Can., 855.
competitive egg-laying test, Okla., 450.
Egyptian, notes, 660.
foulbrood. (*See* Foulbrood.)
inheritance in, 453.
Isle of Wight disease, protection against introduction into America, 357.
outdoor wintering, 659.
queen, oviposition, graphic representation, 558.
spray poisoning, Wash.Col., 251.
studies, Iowa, 757.

Bees—Continued.
swarm control, Can., 855.
toxicity of arsenic to, U.S.D.A., 449.
two-year brood curve for colony, 357.
winter protection, value, 357.
wintering, Wis., 653.
(*See also* Honey.)
Beet—
by-products, feeding value, 870.
fields, child labor and work of mothers in, 795.
leaves, carbohydrates, effect of desiccation methods, 10.
nematode control, 842.
pulp, feeding value, Nebr., 671.
seed, disinfection, 842.
tops, feeding value, Nebr., 671.
tumors, studies, 820.
webworm, life history and habits, 253.
Beetle, East Indian rhinoceros, notes, 50.
Beetles, host selection principle, 448.
Beetles, leaf-eating, affecting cotton, 758.
Beets—
culture experiments, Alaska, 435.
effect on following crop, Mont., 129.
fertilizer experiments, 20.
field or fodder. (*See* Mangels.)
for 1923, Mich., 97.
sugar. (*See* Sugar beets.)
Belascaris marginata, notes, 684.
Belting, leather, specifications, 590.
Belting, oak leather, tests of flesh and grain sides, 486.
Bembecia marginata. (*See* Raspberry root-borer.)
Benzidin in test for phosphoric acid, 407.
Benzoic acid in fruit juices, 805.
Benzol, larvicidal value, 356.
Berries. (*See* Fruits, small, *and* Raspberries, Strawberries, *etc.*)
Betel-vine leaves, disease affecting, 839.
Beverages, fruit, manufacture, Calif., 412.
Bezssonoff reagent for vitamin C, preparation, 805.
Bibliography of—
abortion and associated diseases, Calif., 79.
abortion in cattle, 785.
abortion in mares, 283.
acid soils, 512.
agriculture in America, beginnings, 191.
aphids, 559.
apple and thorn skeletonizer, Conn. State, 557.
arsenicals, U.S.D.A., 450.
artichokes, culture, 37.
bacterial activities of soil, effect of salts, 321.
blackberry psyllid, N.J., 353.
carbon tetrachlorid, anthelmintic value, 77.
Chinese white-wax scale, 355.
Chrysopidae, N.Y.Cornell, 154.
colloid chemistry, 109.
colon-typhoid intermediates, R.I., 81.
cotton boll weevil, wild, Ariz., 558.
Bibliography of—Continued.
djati forest soils of Java, 16.
emphysema, enteromesenteric bullular, 284.
emulsions and emulsification, 109.
Eustrongylus gigas, 177.
forestry, international, 342.
fruit tree leaf roller, Mont., 853.
gastric secretion, 363.
habronemoses of horses, 283.
Hemiptera-Heteroptera, 252.
insecticides, U.S.D.A., 551.
lead determination in biological material, 113.
leucosis of fowls, 81.
milk production, 876.
mucormycosis in swine, 381.
nematodes of Barbary, 482.
organic matter in soils, N.Y.Cornell, 117.
peach twig-moth, Calif., 53.
populist movement in Georgia, 93.
Portland cement, setting, 485.
project methods in education, 194.
Psyllia mali 153.
rickets, 365.
rubber brown bast, 446.
salmon, spoilage in, 803.
Sarcocystis tenella, 682.
Sarcoptes equi, 381.
silicate rocks, use as potassic fertilizer, 817.
silkworms, diseases of, 154.
soil acidity, 513.
soil moisture as affected by mulches, 318.
soils, forest, of Java, 16.
Stephanurus dentatus, 787.
strawberry weevil, Ark., 554.
tractor hitches, Calif., 287.
woods of the world, 440.
Bichlorid of mercury. (*See* Corrosive sublimate.)
Billbugs, cocklebur, biology, 56.
Bindweed—
control, 136; Calif., 136.
eradication experiments, Kans., 427.
Biochemistry of plants, treatise, 218.
Biocolloids. (*See* Colloid.)
Bios and vitamin B, supposed identity, 857.
Birch leaf skeletonizer, 50.
Bird—
censuses in United States, U.S.D.A., 652.
censuses, value and taking, U.S.D.A., 151.
life, importance, treatise, 151.
Birds—
conservation laws of Maryland, 250.
in savage Sudan, 847.
land, of Illinois, numbers and distribution, 151.
migratory movements, U.S.D.A., 351.
of eastern United States, treatise, 251.
of Pribilof Islands, U.S.D.A., 652.
utility, 50.

Bitterns from salt pans in Cape Province, analyses, 726.
Black flies, control, N.H., 352.
Black fly in Cuba, 253.
Black medic, culture experiments, Tex., 429.
Blackberries—
fertilizer experiments, Oreg., 532.
variety tests, Idaho, 740.
Blackberry—
mosaic, notes, Oreg., 755.
plantations, establishment and care, Oreg., 742.
psyllid, life history and habits, N.J., 353.
Blackhead in turkeys, treatment with arsenical compounds, 382.
Blackleg—
differentiation from similar pathological conditions, 680.
immunization, 78, 282.
in cattle, summary, Mont., 480.
vaccines, production and use, Kans., 680.
Blissus leucopterus. (*See* Chinch bug.)
Blister canker, Illinois, control, Iowa, 747.
Blister mite, control, Mont., 251.
Blood—
calcium content during pregnancy, 765.
creatinin determination in, 113.
hemoglobin determination in, 113.
iron determination in, 113.
nitrogen determination in, 111.
of children, inorganic phosphorus in, 764.
of equines, 683.
of thyroidectomized animals, calcium content, 765.
phosphate in infants, seasonal tide, 58.
platelets as affected by vitamin A deficiency, 61.
platelets of rats, effect of vitamin A on, 562.
reaction during mental work, 560.
sugar—
determination, modification, 14.
determining, McLean method, criticism, 806.
estimation, technique, 408.
nature of, 715.
of diabetics, nature, 715.
variation in avitaminosis, 565.
transfusion in domestic animals, 178.
Blue grass, Kentucky, life history, 528.
Blue grass seed, marketing, Ky., 892.
Blueberry maggot, summary, Me., 657.
Body development of successive offspring of same parents, 568.
Bog forests, destruction and replacement, 239.
Boiler, small domestic, heat transference and combustion tests in, 688.
Boll weevil. (*See* Cotton boll weevil.)
Bollworm. (*See* Cotton bollworm.)
Bombyx mori. (*See* Silkworms.)
Bone black, decolorizing action, 506.
Bone grinders, tests, 486.
Bone meal and flour phosphates, comparison, 123.
Bone meal, fertilizing value, Kans., 427.
Books on—
agricultural—
analysis, 407.
cooperation, 391.
cooperation in India, 93.
department of a country bank, 295.
education, vocational, 493.
facts and figures, 193.
labor, 191.
agriculture in—
America, beginnings, 191.
Tropics, 96.
air and its ways, 614.
alcohol as motor fuel, 286.
animal—
diseases, 278.
diseases and bacteriology, 177.
parasites, 377.
pests of orchard, garden, and ornamentals, 654.
animals—
and their environment, 756.
domestic, 278.
domestic, care, 377.
young, diseases, 782.
young, hygiene and nutrition, 772.
ants, 453.
atmospheric circulation, 614.
automobile, gasoline, 85.
bacteriology, 125, 625.
bacteriology, agricultural, 819.
bacteriology and animal diseases, 177.
baking, technology, 114.
bank agricultural department, 295.
beekeeping, 660, 762.
biochemistry of plants, 218.
bird life, importance, 151.
birds of eastern United States, 251.
botany, 125.
catalytic reactions, 109.
chemical analysis, 110.
chemical preparations, 608.
chemical-technical analysis, 110.
chemical technology, 608.
chemistry, 110, 202, 608.
chemistry, applied, 608, 801.
chemistry, organic and biological, 801.
chestnuts, 837.
church and community survey of—
Pend Oreille Co., Wash., 94.
Salem Co., N.J., 94.
citrus culture in Florida, 438.
colloidal behavior and proteins, 109.
colloids, 109.
colloids, soil, 414.
concrete, manufacture and use, 484.
corn plant structure, 528.
cotton, 528.
country newspaper, 595.
dairy farming, 778.
dairy products, production and trade, 376.
dairying, 778.
dogs, breeding and care, 373.

Books on—Continued.
drugs, microscopic examination, 12.
economic and commercial prospects of Italy, 693.
electric ranges, 589.
electrical engineering, 483.
electricity, 286.
electricity in agriculture, 589.
emulsions and emulsification, 109.
engineering—
construction costs, 184.
economics, 483.
on the farm, 482.
farm engines, 589.
farm fertility, 510.
farm meats, 570.
farm mechanics, 284.
farm mortgage financing, 594.
farming, hill, in England and Wales, 491.
fertilizer industry, 422.
field crops, 31.
filtration, 202.
flour milling, 114.
flowers, shrubs, etc., in California, 438.
food chemistry, 559.
food production in England, 389.
food production in war, 290.
foods, microscopic examination, 12.
forest regulation, American, 238.
forests of New York State, 142.
forests, vanishing, 341.
fungicides, 51.
gardening, 836.
gardens, 439.
gardens, historic, 836.
geology, 510.
grafting in India, 741.
grain, handling, 293.
heredity in poultry, 674.
heredity, Mendelian, 266.
horses, anatomy, 381.
immunity, 78.
insecticides, 51.
insects, instincts and habits, 251.
land nationalization, 389.
land valuation, 90.
lumber kiln drying, U.S.D.A., 386.
mange and allied mites, 76.
meat packing and allied industries, 370.
meats, 570.
mechanical testing, 887.
mechanics, analytical, 284.
mechanics, farm, 284.
milk, 175.
mites, parasitic, 76.
motor fuel, alcohol as, 286.
oils, fats, and waxes, 608.
parasites, animal, 177.
parasitology, 76, 177.
pharmaceutical and food analysis, 407.
physiology, chemical, 358.
physiology, human, biochemistry in relation to, 559.
pigeons, raising, 297.
pigs and bacon curing, 470.
plant breeding, 735.
Books on—Continued.
plant life and growth, 836.
plants, ornamental, 439.
polysaccharids, 803.
poultry, inheritance in, 674.
poultry raising, 171.
protein therapy, 78.
proteins and theory of colloidal behavior, 109.
research data, 392.
resins, synthetic, 207.
roses, 438, 743, 835.
rural church survey, 94, 893.
rural community activities, 391.
rural community, evolution of, 391.
rural Europe, 191.
rural life and education, 296.
sap ascent, physiology of, 820.
seed industry in Germany, 232.
shrubs, ornamental, 835.
soil colloids, 414.
soil management, 510.
soils, 616.
soy beans, 35, 230.
spiders, 256.
spraying and dusting equipment, 51.
starch products, 503.
Sudan, savage, 847.
surveying and boundaries, laws, 483.
surveying for settlers, 384.
textile industry, 528.
tobacco, culture and preparation, 36.
trees, identification, 836.
trees, shade, 439.
vegetables, culture, 832.
ventilation, 591.
veterinary hygiene, 278.
wood conservation and improvement, 83.
woods of Madagascar, 440.
zootechny, 772, 782.
Borax—
effect on growth and—
fruiting of cotton, 217.
yield of crops, U.S.D.A., 324.
toxicity for plants, 217.
Bordeaux mixture—
and lime sulphur, comparison, Iowa, 746.
faulty lime in, 145.
specific insecticide for leafhoppers, 654.
stimulatory action, N.H., 328.
use against apple anthracnose, Oreg., 538.
use against apple blotch, Okla., 445.
v. lime sulphur, 44.
white arsenic in, 50.
Bordet-Gengou reaction, use, 481.
Borer, flat-headed, repellant, Mich., 495.
Boric acid in fruit juices, 805.
Botany, introductory, course in, 97.
Botany, textbook, 125.
Botryodiplodia theobromae, notes, 540.
Botrytis cinerea—
for bean seed treatment, 841.
notes, 650, 844; Calif., 649.
on stored corn, 842.

Botrytis cinerea—Continued.
sources of sulphur for, 26.
spores, factors affecting germination, 125, 240.
Botrytis stephanoderis n.sp., description, 255.
Bots, control, 77.
(*See also* Ox-warbles.)
Botulinus antitoxin, Ky., 586.
Botulism—
as affected by calcium chlorid, 667.
epidemiology of, 859.
in domestic animals, Ky., 586.
investigation, 860, 861, 862, 863.
outbreak in Scotland, 862.
review of literature, 366.
studies, Ill., 365.
Bovine serum, anticomplementary action, 879.
Boxwood, Turkish, present uses, 143.
Boys' clubs—
making articles for household use, directions, 297.
of Northern and Western States, status and results, U.S.D.A., 394.
organization, Alaska, 491.
organization in Iowa, 96.
Bracken fern, control, 33.
Braconidae, life history, 559.
Bran, standards for, 65.
(*See also* Wheat bran.)
Brassica spp., cyclic manifestation of sterility in, 425.
Braxy vaccine, preparation, 181.
Bread making and flour, 660.
Bread, mold in, Wis., 660.
(*See also* Flour.)
Breadstuffs, detection of milk in, 611.
Breeding. (*See* Heredity, Hybridization, Inbreeding, *and* Plant *and* Animal breeding.)
Bremia lactucae, notes, 45, 346.
Brick wall and roof construction, heat conductivity, 188.
Broccoli, canning, Oreg., 507.
Brome grass, culture experiments, 735; Mont., 430.
Bromobenzol, effect on normal and rice-fed pigeons, 766.
Broomcorn—
culture experiments, Tex., 429; U.S.D.A., 630.
returns from, in Georgia, 90.
variety tests, Tex., 429; U.S.D.A., 630.
Brown rot fungi, studies, 248.
Brown-tail moth—
control, U.S.D.A., 852.
vacuum fumigation experiments, 654.
Brown weevil, large, parasites and enemies, 50.
Bruchus obtectus. (*See* Bean weevil.)
Brussels sprouts, culture experiments, Alaska, 435.
Bryophyllum calycinum, cut stems, curvature, 127.
Bubble-counting technique for submerged plants, 423.
Bucculatrix canadensisella, notes, 50.
Buckwheat—
as chinch bug control crop, Ill., 431.
culture experiments, Alaska, 426.
growth and composition as affected by length of day, 739.
nickel and cobalt in, 520.
production in United States, U.S.D.A., 389.
variety tests, Can., 734.
Bud development, periodicity of, 127.
Bud variation in plants, experiment station research in, 104.
Buddleia globosa, propagating in acid medium, 836.
Budworm infestation v. pulpwood production, 452.
Bulls—
fertility and sterility in, 178.
power from, Mont., 184.
vitality and breeding ability, factors affecting, Wash.Col., 275.
(*See also* Sires.)
Bulrush leaf miner, life history, N.Y.Cornell, 854.
Bunostomum trigonocephalum, freeliving larval stages, 499.
Bunt. (*See* Wheat smut, stinking.)
Buprestids on blackberry, biology, 848.
Bureau of—
Education, Federal, relation to State universities and colleges, 491.
Home Economics, plan, 596.
Soils and Reclamation Service, cooperation, 616.
Burkheiser salt, fertilizing value, 20.
Butter—
acidity, 176.
adulteration, detecting, 311.
effect of grade of cream, Okla., 475.
effect of temperature of cream, 74.
fat. (*See* Milk fat.)
fishy flavor in, 74, 176, 679.
from pasteurized cream, 700.
making, bacteriological background, Mich., 878.
moisture determination in, 113.
production and trade, 376.
salt determination in, 113.
stored, variations in bacterial content, 176.
Buttermilk—
as protein supplement for pigs, Mich., 469.
as source of minerals for poultry, 674.
dried, as source of protein for hens, Idaho, 777.
feeding value, 273.
fresh v. dried for poultry, Iowa, 777.
semisolid, feeding value, Can., 70; Ky., 574.
Cabbage—
aphids, control by soap, N.C., 757.
aphids, extermination, 555.
aphids, notes, N.Mex., 554.
Chinese, self-sterility in, 137.
clubroot, notes, 44.
culture experiments, Alaska, 435.

Cabbage—Continued.
disease in Rio Grande valley, Tex., 442.
dusting for worms, N. C., 757.
effect of phosphatic fertilizers, 726.
fertilizer experiments, N.Mex., 532; Ohio, 337.
fertilizer experiments with goat manure, N.Mex., 517.
flea beetle control, 252.
irrigation experiments, N. Mex., 532.
maggot control, 50, 557; N.H., 351; Pa., 251.
maggot in Ontario, summary, 558.
maggot, surface treatment, N.H., 853.
mulching experiments, Ohio, 337.
notes, R.I., 533.
varieties, U.S.D.A., 636.
vitamin C in, destruction by heat, 563.
vitamin content, effect of cooking, 663.
worms, control, Wis., 653.
yellows in seedlings, effect of soil temperature and moisture, 542.
yellows, resistant strain, Iowa, 747.
yellows, resistant strains, Wis., 644.
Cacao—
breeding experiments, 735.
butter analysis, method, 611.
cryptogamic diseases, 539.
in Panama, froghopper affecting, 450.
insects affecting, 654.
thrips in Porto Rico, 555.
Cachaza—
fertilizing value, 23.
value for run-down soils, 518.
Cacoecia argyrospila, summary, Mont., 254.
Cactus, culture and propagation, 836.
Cadmium chlorid in diet, chronic intoxication by, 258.
Caesium in Hagerstown soil, 617; Pa., 210.
Calandra granaria. (*See* Granary weevil.)
Calandra infestation, transmitting from wheat to macaroni through milling, 855.
Calandra oryza. (*See* Rice weevil.)
Calceolaria spp., propagating in acid medium, 836.
Calcium—
absorption in children on low fat diet, 457.
alimentary absorption and deposition in tuberculosis, 379.
ammonium nitrate, fertilizing value, 623.
and sodium, pseudo-antagonism in dilute solution, 730.
arsenate dust, insecticidal value, 759.
arsenate, properties, U.S.D.A., 448.
assimilation, factors causing, 675.
assimilation, vitamin concerned in, Wis., 167.
balance of dairy cows, 779.
carbonate, relation to soil solution, 518.
carbonate, use in nitrogen fixation experiments, 515.
caseinate as spray spreading agent, 51; Mont., 853.
caseinate, insecticidal value, 760.
Calcium—Continued.
caseinate, value in spray solutions, Oreg., 549.
chlorid, effect on experimental botulism, 667.
chlorid, use as protection against freezing of concrete, 385.
content of blood during pregnancy, 765.
content of blood of thyroidectomized animals, 765.
content of rain water, 413.
cyanamid, fertilizing value, 19, 623.
cyanamid, insecticidal value for nursery stock, 451.
cyanid dust, insecticidal value, 849.
metabolism, effect of vitamins, 58.
nitrate, fertilizing value, 20.
salts, effect on absorption by orange trees, Calif., 628.
salts, effect on glucose determination, 112.
sulphate. (*See* Gypsum.)
(*See also* Lime.)
Calf clubs, organization, 297.
Calf diphtheria in Wisconsin, Wis., 681.
Calf diseases, U.S.D.A., 875.
California—
Station, notes, 98, 396, 496.
University, notes, 98, 396, 496.
Calliphorinae, Indian, notes, 55.
Callisaurus ventralis ventralis, food habits, 151.
Calves—
digestion experiments, N.Mex., 869.
feeding, West.Wash., 72.
feeding and management, 297; U.S.D.A., 875.
feeding experiments, 72, 473; Wash. Col., 275; Wyo., 466.
infection with abortion bacilli from cow's milk, 680.
optimum quantity of skim milk for, 676.
protein requirements for growth, Pa., 274.
raising, 173.
raising on milk substitutes, Oreg., 579.
range, wintering, Wyo., 867.
self-feeder for, Mont., 172.
systems of marking, U.S.D.A., 875.
winter feeding, Mont., 167.
Calyx spray formula, Conn.State, 742.
Camphor—
Borneo, root disease, control, 548.
die-back, notes, 839.
producing industry of Taiwan, 43.
Campoplex pilosulus, studies, 555.
Canadian—
National Live Stock Records, 267.
Society of Technical Agriculturists, 200.
Canals, irrigation. (*See* Irrigation.)
Canaries, management, U.S.D.A., 675.
Canary grass, reed, culture experiments, 735.
Canary seed culture in Morocco, 595.
Cancer inheritance, papers on, 567.

Candy, pear, preparation, Calif., 206.
Cane—
borer, red-necked, studies, Wis., 654.
fruit industry, Oreg., 742.
Japanese, notes, Guam, 427.
maggot, notes, Oreg., 555.
(*See also* Sugar cane.)
Cankerworm, fall, control, N.C., 757.
Canned vegetables, spoilage in, Colo., 412.
Cannibalism as affected by restricted diet, 767.
Canning—
industry, sanitation in, 462.
problems in relation to botulism, 862.
Cantaloups. (*See* Muskmelons.)
Capillary phenomenon, Bechhold's, 811, 812.
Capsicum, vitamin A in, 769.
Carabao. (*See* Water buffalo.)
Carbohydrate—
and amino acid relation in respiration of leaves, 728.
configuration and bacterial utilization, 610.
metabolism in avitaminosis, 565.
mixtures, measurement, 610.
production by sun and shade leaves, 728.
reserves of nursery apple trees as affected by winter storage, 138.
Carbohydrates—
and fats in nutrition, 362.
effect on elimination of endogenous uric acid, 662.
effect on nitrogen distribution in urine, 257.
estimation by bacterial procedures, 609.
identification by bacterial procedure, 609.
of plant tissues, effects of desiccation, 9.
predominance in diet, effects, 359.
proteins, and fats, unusual proportions in diet, effect, 360.
rôle in vitamin hunger, 364.
utilization by rats deprived of vitamin B, 857.
Carbolic acid for bean seed treatment, 841.
Carbon—
bisulphid, anthelmintic value, 77.
bisulphid, effect on germination of seeds, 849.
content of solutions, determination, 803.
dioxid—
as atmospheric fertilizer, 216.
assimilation, Blackman's theory of limiting factors, 127.
determination on grassed and cultivated soils, 120.
dissolved, determination, 504.
effect on *Aucuba japonica* cuttings, 836.
fertilization, theoretical and practical basis, 421.
fertilizing effects, 741.
Carbon—Continued.
dioxid—continued.
manuring, 522.
production as affected by gypsum, 727.
tension, alveolar, relation to meals, 560.
disulphid, use against stored grain pests, 153.
organic, in soil, factors affecting, N.Y.Cornell, 117.
tetrachlorid—
anthelmintic value, 76.
effect on intestinal protozoa, 476.
for fox parasites, 382.
toxicity, 476.
toxicity, relation to liver function, 382.
Carbons, decolorizing, review of literature, 614.
Carnation Fusarium wilt, 45.
Carnations, culture in greenhouse, Ill., 336.
Carob bean pods, feeding value, 173.
Carpocapsa pomonella. (*See* Codling moth.)
Carpomyia vesuviana, trypetid affecting, 849.
Carrots—
culture experiments, Alaska, 426, 435.
effect on following crop, 231.
nickel in, 520.
variety tests, Can., 734.
Casein—
as protective agent for fat globules in milk, 804.
fat determination in, 609.
Indian, proportion of fat in, 609.
new sulphur-containing amino acid from, 714.
purification and precipitation, 802.
Cassava—
breeding experiments, 735.
meal, feeding value, 169.
molasses meal, feeding value, 169.
variety tests, Guam, 427
Castor—
bean gray mold, studies, N.H., 345.
beans, breeding experiments, 735.
meal residues, ricin in, 14.
Casuarina roots, nitrogen-fixing bacteria in nodules, 745.
Catalase activity in apple leaf tissue, N. Y. Cornell, 28.
Catalpa sphinx, control by airplane, 654.
Catalysis, soil, studies, 418.
Catalytic reactions, treatise, 109.
Caterpillar, aquatic, of *Nymphula* sp., 53.
Caterpillars of *Galleria mellonella*, disease of, 155.
Cats—
blood, nature of sugar in, 715.
internal parasites, treatment, 684.
newborn, respiratory exchange in, 15.
Cattle—
and beef in United States, tariff problems, 795.
baby beef, production, Wis., 669.

Cattle—Continued.
beef, effect of age on economy of gain, Nebr., 772.
beef, feeding experiments, Idaho, 772; Mont., 167.
beef, feeding the breeding herd, Miss., 465.
beef, pasturing experiments, Miss., 465.
Brahma-Hereford, cross, Tex., 467.
breeding, 72.
breeding experiments, Alaska, 467.
breeds, 778.
breeds, milk and fat production, 174.
breeds, Swiss, identification, 268.
crate, design, Mich., 487.
crisis in Argentina, U.S.D.A., 90.
dairy. (*See* Cows.)
diseases—
and parasites in Morocco, 400.
notes, 277.
of genital tract, Calif., 79.
relation to milk supply, 699.
(*See also specific diseases.*)
effect of wintering on pasture gains, 868.
feed, digestion experiments, errors in, 864.
feeding experiments, 869; Guam, 464; Nebr., 772.
(*See also* Calves, Cows, Heifers, *and* Steers.)
feeds for wintering and fattening, Can., 67.
grazing, effect of different systems and intensities, U.S.D.A., 866.
hair color in, value, 268.
Hereford, great families and individuals, 865.
Holstein-Friesian—
measurements of parts, 878.
true type of breed, 72.
inbreeding in, Ohio, 375.
inheritance of milk and meat production in, Wis., 676.
Jersey and Red Danish, genetic study of records, 474.
mineral requirements, 72.
official testing, Oreg., 579.
ovary, anatomical development, 781.
parasites of, La., 283.
plague. (*See* Rinderpest.)
poisoning. (*See* Livestock poisoning, Plants, poisonous, *and specific plants.*)
pregnancy in, diagnosis, Calif., 79.
production on Madeira Islands, 474.
protein requirements for growth, Pa., 274.
purebred, tests, effect of leaving milk in udder, Pa., 274.
raising, courses in, 96.
salting studies, Kans., 466.
testing with human and bovine tuberculin, 783.
tick in Guam, Guam, 480.
(*See also* Ticks.)
Cattle—Continued.
tuberculization method by double local reaction, 78.
wintering, Idaho, 779.
(*See also* Calves, Cows, Heifers, *and* Steers.)
Cauliflower—
canning, Oreg., 507.
culture experiments, Alaska, 435.
(*Cecidomyia*) *Mayetiola destructor.* (*See* Hessian fly.)
Cecropia moth, natural control, 50.
Celery leaf blight, control, Mich., 443.
Cellulose, mannose in, 206.
Celluloses, separation and determination, 409.
Cement, Portland, setting, 484.
Cement production, consumption, and foreign trade in 1921, 588.
(*See also* Concrete.)
Centeter cinerea n.g. and n.s.p., description, 453.
Cephaleuros sp., notes, 45.
Cephalic indexes, 770.
Cephalosporium—
sacchari, notes, 542.
sacchari in seed corn, 243.
sp., notes, 45.
Ceratomia catalpae. (*See* Catalpa sphinx.)
Ceratonia siliqua. (*See* Carob.)
Ceratostomella—
piceae, notes, 250.
pilifera, notes, 447.
Cercospora—
capsici, notes, Ga., 346.
nicotianae, notes, Fla., 838.
Cereal—
crop diseases, N.Dak., 343.
diseases in England and Wales, 645.
diseases in Kentucky, Ky., 541.
extracts, protein removal from, technique, 110.
research, Federal and State cooperation in, 492.
rusts. (*See* Rusts *and specific host plants.*)
seeds, fungi on, 443.
smut. (*See* Smut, Grain smut, Corn smut, Wheat smut, *etc.*)
Cereals—
congress of, proceedings, 736.
cytological studies, 25.
experiments, U.S.D.A., 825.
in Algeria, improvement, 736.
manganese and iron determinations, 520.
production in Spain, 193.
stomatal behavior in, 422.
studies, S.Dak., 527.
tests, 825.
varieties for winter grazing crops, Fla., 824.
yields as affected by seed, 130.
(*See also* Grain *and specific grains.*)
Ceromasia interrupta, notes, 356.

Cerotoma trifurcata. (*See* Bean leaf-beetle).
Certified Milk Producers' Association of America, 175.
Chaetexorista pavana, notes, 657.
Chalcid flies, type species, 256.
Chalcidoidea, type species, 256.
Chalk, ground, solubility, 512.
Chalks, analyses, 512.
Chaparral—
and related communities, ecological study, 822.
of southern California, 837.
Charcoal, activated ash-free, adsorption of acid dyes by, 505.
Charcoal, thermal conductivity, 186.
Chaulmoogra oil plantation, discussion, 143.
Cheese—
Camembert, manufacture, U.S.D.A., 878.
Cheddar, manufacture, 75.
Cheddar, quality, relation to bacteria, 176.
cold-storage holdings, U.S.D.A., 893.
factory, establishment, 277.
making with clarified milk, N.Y.Cornell, 475.
of Spanish ewes, 75.
production in Ontario, 176.
production and trade, 376.
ripening, 176.
Swiss, eye-forming culture, Wis., 679.
Swiss, making, methods, Wis., 679.
Swiss, production in Sweden, 75.
Swiss, stinker, cause, Wis., 679.
Chemical—
agents, effect on oxidation of soil-forming rocks, 617.
analysis, treatise, 110.
preparations, handbook, 608.
technical analysis, treatise, 110.
technology, treatise, 608.
Chemicals as repellents, attractants, and larvicides, tests, 356.
Chemistry—
agricultural, yearbook, 407.
applied, progress, 608.
applied, textbook, 801.
calendar, 110.
colloid, applications, 308.
colloid, bibliography, 109.
organic—
and biological, textbook, 801.
laboratory manual, 501.
methods, 110.
progress, 608.
yearbook, 1923, 202.
Chemotherapy and plant pathology, 839.
Chenopodium—
anthelmintic value, 77.
oil, methods of administering, 788.
Cherries—
culture experiments, Alaska, 435.
new or noteworthy, N.Y.State, 338.
pollination studies, Oreg., 532, 534.
Cherries—Continued.
pruning experiments, N.Y.Cornell, 638.
self-sterility and cross-incompatibility in, 234.
sour, fertilizer experiments, Mich., 438.
spray schedules for, N.J., 138.
time of fruit bud differentiation, 834.
Cherry—
bacterial gummosis, 845.
beverage, preparation, Calif., 412.
blossom blight, notes, 44.
diseases, parasitic, 1915–1920, 445.
fruit fly, summary, Oreg., 156.
leaf scorch, 45.
leaf spot, notes, 445; Wis., 644.
orchards, fertilization, N.Y.State, 534, 535.
rootstock, identification, Calif., 637.
silver-leaf, notes, 845.
stock, studies, N.Y.State, 38.
Wragg, bacterial disease, Colo., 445.
yellow leaf, notes, 442.
Chestnuts—
absorption of hydrocyanic acid by, U.S.D.A., 457.
monograph, 837.
restoration, 440.
Chicken—
cholera, studies, 182.
disease, toxic anaerobe from, 382.
pox and cowpox, relationship, 379.
pox, control, 178, 183.
serum, normal and immune hemagglutinins in, 879.
Chickens—
as affected by rose chafers, Conn. Storrs, 56.
fattening, results in, 673.
removal of heterakids from ceca, 183.
spontaneous disease of, 684.
(*See also* Chicks, Fowls, Hens, *and* Poultry.)
Chick-pea disease, 45.
Chicks—
brooding, N.J., 273.
crossbred, determining sex at birth, 165.
effect of proteins on nutrition, 172.
feeding and management, West.Wash., 71.
feeding eggs to, Wis., 672.
feeding experiments, Can., 70.
growing, vitamin requirements, 673.
initial weight, effect on growth and mortality, Ind., 573.
nutrient requirements, Nebr., 777.
rations for, Iowa, 777.
teaching to roost, West.Wash., 373.
visual perception of, 273.
young, distinguishing sex, Conn.Storrs, 776.
Chico, vitamin C in, 563.
Chicory, forcing studies, Ill., 336.
Child care, college course on, 492.
Child labor in beet fields, 795.

Children—
calcium absorption on low fat diet, 457.
energy expenditure and food requirements, 762.
food for, 56.
inorganic phosphorus in blood, 764.
physical growth, 662.
underweight, effect of adding orange juice to diet, 662.
weight and height as nutrition index, 257.
(*See also* Boys, Girls, *and* Infants.)
Chilomastix mesnili, notes, 477.
Chilopods of Pribilof Islands, U.S.D.A., 652.
Chimenys, design, formulas for determination of wind pressure, 388.
Chinch bug—
control, Ill., 431, 450.
notes, Iowa, 757.
summary of information, S.Dak., 654.
Chinese banana, vitamin C in, 563.
Chinese white wax scale, studies, 355.
Chinook winds in United States, 808.
Chionapsis pinifolia, notes, 50.
(*Chloridea*) *Heliothis obsoleta.* (*See* Cotton bollworm.)
Chlorin excretion, as affected by potassium feeding, 464.
Chlorophol, fungicidal value, 645.
Chlorophyll—
development, relation to sulphur in soil, 420.
photo-electric properties, 519.
types of corn, cytology of, 423.
Chloropicrin for cotton seed fumigation, 154.
Chlorosis of cottonwood trees, N.Mex., 548.
Chocolate, milk—
determination of milk content, 204.
examination and evaluation, 204.
Cholera vibriones, duration of life in septic tanks, 591.
Cholesterol—
as an essential food constituent, 161.
test for, 410.
Chortophila brassicae, control, 50, 557.
Chromium in Hagerstown soil, 617; Pa., 210.
Chromosomal materials, aberrations in, 567.
Chromosome—
complex, evolution of, 567.
number, variations in, effect, 24.
number, variations in wheat hybrids, 25.
Chromosomes—
homologous, attraction between, 567.
locating genes in, 576.
of Datura, specificity, 24.
rôle in heredity, 165.
Y-(W), inheritance in, 668.
Chrysanthemum midge, new parasite, 56.
Chrysanthemums, insects affecting, U.S.D.A., 152.
Chrysobothris mali, notes, Oreg., 555.
Chrysomyia—
bezziana, notes, 55.
macellaria. (*See* Screw-worm.)
Chrysophlyctis endobiotica, notes, 46.
Chrysopidae, biology of, N.Y.Cornell, 154.
Church—
and community survey of—
Pend Oreille Co., Wash., treatise, 94.
Salem Co., N.J., treatise, 94.
Federated, at Waco, Kans., 893.
Chute for use in dehorning and branding cattle, construction, 87.
Cicinnobolus, pycnidium of, 145.
Cicuta maculata, poisonous to livestock, Ind., 584.
Cigarette beetle, parasite of, 256.
Cinchona, breeding experiments, 735.
Cinnamomum camphora, transplanting experiments, 745.
Cinnamon stripe canker, 150.
Citrangequats, new citrus hybrid, 41.
Citric acid in fruit juices, 805.
Citricola scale in Japan, synonym, 355.
Citrus—
blast and black pit, Calif., 650.
blast in California, inoculation, chambers for, 821.
blast outbreak in California, 846.
brown rot, control, 846.
canker, eradication, 547.
canker in Tunis and Algeria, 45.
collar rot, control, 547.
culture in Florida, handbook, 438.
diseases. (*See* Lemon, Orange, *etc.*)
fruit beverage, preparation, Calif., 412.
fruits, breeding experiments, 735.
fruits, exports from South Africa, cause of waste, 249.
(*See also* Lemons, Oranges, *etc.*)
gumming diseases, Calif., 649.
gummosis, nature, causes and development, 650.
hybrids, new types for home garden, 41.
industry in Japan, 438.
nematode, studies, Calif., 350.
orchard, fertilizer experiments, 834.
pectin extracts, homemade, use, U.S.D.A., 114.
plants, relative susceptibility to *Cladosporium citri,* 846.
tear stain, notes, 846.
thrips, control, Fla., 847.
trees—
fumigation, U.S.D.A., 849.
pruning, Calif., 641; U.S.D.A., 742.
spraying experiments, Fla., 838.
withertip, notes, 846.
Cladosporium—
citri, susceptibility of citrus varieties to, 846.
spp., notes, 149.
Clastoptera theobromae n.sp., description, 450.

Clay—
analysis, 414.
as an ampholyte, 811.
colloidal, flocculation, relation to H-ion concentration, 503.
Clays, colloidal, analyses, 811.
Clays, pleistocene, colloidal properties, 811.
Climate—
and weather of Vermont, 208.
effect on fruit production, N.Y.Cornell, 338.
evolution, 412.
of Algeria, 208.
of British Columbia, 15, 615.
of Nebraska, 115.
of Panama, U.S.D.A., 719.
tropical, effect on Surinam soils, 511.
(*See also* Meteorology.)
Climates, evolution, 15.
Climatological data. (*See* Meteorological observations.)
Climatic cycles, studies, 30.
Clinorchis sinensis infestations, diagnosis, 78.
Clostridium botulinum—
agglutination studies, 881.
under household conditions, 567.
(*See also Bacillus botulinus.*)
Clouds, artificial, for frost protection of vineyards, 615.
Clover—
alsike—
as affected by pH, 825.
culture experiments, Alaska, 426.
seed production trials, Can., 734.
as affected by gypsum, 727.
as affected by sulphur, Ohio, 625.
as orchard cover crop, Mont., 833.
as protein supplement for pigs, Mich., 469.
culture experiments, 329; Alaska, 426.
effect on following crop, Ohio, 329.
experiment station, new, Mich., 495.
hay v. alfalfa for heifers, Ohio, 375.
hogging down, cost and returns, Ohio, 372.
Japan, culture, La., 824.
Japan, value, N.C., 733.
leaf weevil in Iowa, 761.
mixture, yields, Ohio, 329.
mosaic disease, protozoa with, Mich., 45.
red, as affected by pH, 825.
red, breeding experiments, Oreg., 525.
red, culture experiments, Oreg., 525.
red, fertilizer experiments, Oreg., 525.
red, for seed, seeding experiments, 735.
red, seed consumption in United States, 32.
red, seed production trials, Can., 734.
red, seeding experiments, Oreg., 526.
red, self-fertility in, Ky., 131.
red, varieties for silage, N.H., 328.
red, variety tests, Can., 734; Oreg., 525.
root curculio, notes, Ind., 548.
root rot, Ky., 543.
rotation experiments, Ohio, 725.
Clover—Continued.
seed midge, new parasite on, 157.
seeding experiments, Can., 734; Idaho; 736.
seedings, effect of previous crops, Can., 734.
seeds, iron and manganese content, 202.
subterranean—
behavior and adaptation, Fla., 824.
value, N.C., 733.
sweet. (*See* Sweet clover.)
use as cover crop, Mont., 136.
varieties, comparison, Ohio, 329.
variety tests, Idaho, 732.
wilt disease, notes, 44.
Club work. (*See* Boys' clubs *and* Girls' clubs.)
Cnemidophorus tessellatus, notes, 151.
Cnidocampa flavescens. (*See* Oriental moth.)
Coal gas, toxic action upon plants, 522.
Coal tar as source of fuel for internal-combustion engines, 590.
Cobalt, effect on Aspergillus growth, 27.
Cobalt in plants, 520.
Coccidiosis—
in cattle, 181, 377.
in chickens, 599.
in pigs, occurrence, 182.
Cockerels—
effect of vitamin B on growth of organs, 569.
method of handling, West.Wash., 576.
Cockroaches in Porto Rico, 252.
Cocoa pests, 654.
Cocobolo, distribution and value, 744.
Coconut—
breeding experiments, 735.
juice, vitamin C in, 563.
leaf beetle, two-colored, notes, 658.
oil, losses in refining, 311.
red stripe weevil, summary, 855.
Coconuts—
as affected by Para grass, Guam, 427.
culture, 743.
fertilizer experiments, Guam, 435.
legume cover crops for, Guam, 427.
Cod liver oil—
chemistry of, 608.
effect on antiscorbutic factor of lemon juice, 58.
effect on tuberculosis in guinea pigs, 479.
in winter feeding of milch cows, 780.
osteodystrophic power with deficient diet, 566.
potency of vitamin in, 461.
Codling moth—
control, Idaho, 756; Wash.Col., 251.
control in Western New York, 152.
control in Oregon, 452.
in Illinois, studies, 54.
in pears, control, 759.
relation to temperature, U.S.D.A., 509.
studies, summary, N.Mex., 154.

Codling worm, life history and correlated spraying program, Ohio, 656.
Coelinidea meromyza, notes, S.Dak., 549.
Coffee—
berry beetle borer in Java, parasites of, 255.
breeding experiments, 735.
diseases, 547.
insects, notes, 550.
leaf disease, studies, 150.
leaf spot, notes, P.R., 150.
phloem necrosis, notes, 150.
roasted, antineuritic action, 663.
Cognogethes punctiferalis, notes, 758.
Coke in domestic appliances, efficiency, 289.
Cola, breeding experiments, 735.
Cold—
storage, effect on beef and mutton, differences, 11.
storage holdings, U.S.D.A., 892.
surfaces, insulation to prevent sweating, 591.
waves in Brazil, 314.
Coleoptera of France, keys to genera, 761.
Colic, forms of, 283.
Collard dusting for worms, N.C., 757.
College teaching, improvement, 492, 704.
College winnings at 1922 International, Mich., 97.
Colleges. (*See* Agricultural colleges.)
Colletotrichum—
circinans, notes, Wis., 644.
gloeosporioides, notes, 846.
gossypii, notes, N.C., 747.
gossypii spore germination, effect of acidity, 125.
lagenarium, notes, Tex., 442.
oligochaetum, control, 146.
phomoides, notes, 149.
spp., notes, 540.
Collodium osmometers, preparation and use, 520.
Colloid chemistry, applications, 308.
Colloid chemistry, bibliography, 109.
Colloidal—
behavior and proteins, treatise, 109.
clay, flocculation, relation to H-ion concentration, 503.
clay in soils, amount and composition, 811.
content of soils, effect on mechanical analysis, 316.
silica, adsorption of plant food by, 17.
Colloids—
in soil separates, microscopic estimation, 722.
properties, treatise, 109.
soil, adsorption of plant food by, 17.
soil, treatise, 414.
Colocasia antiquorum, transpiration stream, reaction of, 520.
Colon typhoid intermediates as cause of disease in birds, R.I., 81.
Color—
factors, new, in guinea pigs, 368.
inheritance in pigs, Pa., 269.
inheritance in rabbits, 66.
(*See also* Pigments.)
Color—Continued.
of hair, dark winter, production, 165.
of soils, relation to organic matter in, Iowa, 318.
standards, need for use in field, 616.
Coloradia pandora, notes, 655.
Colorado Station, report, 494.
Colostrum—
problem and solution, 283.
relation to immunity of newborn calves, 480.
Colts, cost of raising, 69.
Colts, feeding and care, 297.
Combustion and heat transference in domestic boiler, 688.
Commercial statistics of Japan, 895.
Commodities, quantity and price, statistical data, 392.
Commodity prices and farming policy, 692.
Communities, associate and federate, 295.
Community—
and church survey of—
Pend Oreille Co., Wash., treatise, 94.
Salem Co., N.J., treatise, 94.
fairs, suggestions for, 96.
improvement. (*See* Rural communities.)
Life Campaign in Virginia, 295.
needs, diagnosing, 596.
work among Pima Indians in Arizona, 894.
Complement—
deficient guinea pigs, blood elements in, 880.
fixation test in tuberculosis, 883.
Compsilura concinnata, studies, 555.
Concrete—
constituents, estimation, 588.
draintile, effect of organic decomposition products, 790.
fence posts, studies, Iowa, 788.
freezing, protection against, 385.
house building details, 87.
integral waterproofings for, 286.
manufacture and use, treatise, 484.
sand and water for, measurements, 285.
stone screenings as aggregate for, 384.
Condiments, chemistry of, treatise, 559.
Congress of Cereals, proceedings, 736.
Coniferous—
nursery stock, snow molding in, 755.
timber, bluing of, 447.
Conifers, bud relation to trunk growth, 28.
Coniothyrium berlandieri, notes, 45.
Conisporium arundinis, description, 445.
Connecticut—
College, notes, 98.
State Station, notes, 299, 899.
State Station, report of director, 696.
Station, notes, 98.
Conotrachelus nenuphar. (*See* Plum curculio.)
Contarinia gossypii, control, V.I., 353.
Cookery, home, use of gas for, 57.
Cooperation. (*See* Agricultural cooperation.)

Cooperative societies for housing in India, 191.
Cooperia spp., notes, La., 283.
Copper—
acetates, adhesive quality, N.H., 349.
carbonate—
dusting for smut control, 645.
fungicidal value, 646.
powdered, use in smut control, Oreg., 538.
v. copper sulphate for smut control, Idaho, 746.
dust, for stinking smut, Mich., 841.
in marine animals, 258.
oxid, insecticidal value, U.S.D.A., 449.
salts, effect on bacteriological analysis of water, 285.
sprays, effect on yield and composition of potatoes, U.S.D.A., 247.
sulphate—
anthelmintic value, Mich., 80.
for stomach worms in sheep, N.C., 787.
treatment of barley, tests, 840.
v. copper carbonate for smut control, Idaho, 746.
tacks, use in control of wood-rotting fungus, Oreg., 539.
Copperas. (*See* Iron sulphate.)
Copra meal, feeding value, Guam, 464.
Cork, thermal conductivity, 186.
Corn—
absorption of water and nitrates, 29.
amount in ration for steers, Ind., 267; Miss., 267.
and cowpeas, hogging-down, La., 272.
and cowpeas, intertillage, Tex., 429.
and soy beans, hogging down, La., 272.
and soy beans, value, Iowa, 732.
as affected by—
borax, U.S.D.A., 325.
cane mosaic, 539.
iron and aluminum salts, 519.
as forage crop, Mont., 430.
borer, European—
in Ontario, control, 155, 848.
in Russia, 356.
studies, Ohio, 352.
vacuum fumigation experiments, 654.
breeding experiments, Idaho, 732; Miss., 428.
canned, spoilage in, Colo., 412.
chlorophyll types, cytology of, 423.
continuous selection, Ill., 329.
cooperative tests, Iowa, 732.
cost of production, N.Y.Cornell, 691.
crinkly leaf, inheritance, 632.
culture experiments, 329; Can., 734; Miss., 428; Mont., 130; Tex., 429; U.S.D.A., 630.
culture in Morocco, 595.
culture under dry farming, Nebr., 527.
demonstrations, results, La., 890.
diseases, studies, Ind., 537.
Corn—Continued.
dry rot, notes, Iowa, 746.
ears, carbohydrates, effect of disiccation methods, 10.
effect on following crop, 231; Nebr., 527; Ohio, 329.
endosperm defects, 826.
exudate water from, solids in, N.Y. Cornell, 520.
fertilizer experiments, 329; Can., 734; Miss., 32, 428.
fine streaked leaves, inheritance, 632.
for silage—
seeding experiments, Idaho, 732.
shrinkage tests, Ohio, 733.
variety tests, Can., 734.
fumigated, hydrocyanic acid absorption and retention by, U.S.D.A., 456.
germ, nutritional value, Ind., 573.
germination as affected by fertilizers, 122.
heating value, 84.
heritable characters in, 632, 826.
hogging down, La., 272.
hogging down, costs and returns, Ohio, 372.
improvement, N.C., 733.
in different forms, feeding value, Ohio, 371.
inheritance in, 225.
inheritance of defective seeds, 826.
laws and corn prices in England, 91.
liming experiments, Pa., 222.
linkage in, N.Y.Cornell, 32.
meal and other feeds, protein efficiency, 369.
mealy endosperm, inheritance, 632.
nicked and cobalt in, 520.
oil, losses in refining, 311.
plant, pentosans in, 201.
plant structure, treatise, 528.
plants, vigor and yield, relation to disease-free seed, 243.
pollen, analysis and composition, N.Y. State, 12, 309.
pollen, composition, 201.
pollination, self- and open, 330.
position in American agriculture, U.S.D.A., 389.
prices and corn laws in England, 91.
processing, 115.
production, labor requirements, 189.
productivity, effect of spacing, U.S.D.A., 431.
project, half-acre, 96.
purchasing power, Nebr., 292.
root rot, prevention, Ohio, 346.
root rot, studies, Ind., 538; Miss., 441.
root rots, relation to absorption of salts, 327.
root tips, excised, cultivation under sterile conditions, 627.
rotation experiments, Nebr., 328; Ohio, 725; Oreg., 526.
Sclerosporas, production and dispersal of conidia in, 46.

Corn—Continued.
seed—
condition, effect on crop, Ill., 343.
fungi internal to, 243, 542.
homegrown, value, Mont., 136.
production, improvement, Nebr., 225.
selection, Ohio, 733.
treatment for downy mildew, 750.
seeding experiments, Ga., 524; Nebr., 733.
seedling blight, factors affecting, 345.
seedlings—
carbohydrates, effect of desiccation methods, 10.
temperature relations, Wis., 644.
seeds, manganese content, 731.
silage. (*See* Silage.)
smut, treatment, Okla., 542.
(*See also* Smut *and* Cereal smut.)
stored, *Botrytis cinerea* affecting, 842.
substitutes for lambs, Iowa, 571.
sweet. (*See* Sweet corn.)
sweet clover as green manure for, Ill., 315.
transplanting, 826.
uses as food, U.S.D.A., 158.
v. oats, feeding value, 69.
varieties, Wis., 629.
varieties—
culture, Miss., 222.
for chinch bug infested areas, Ill., 330.
for silage, N.H., 328.
good, Mich., 97.
yields, Va., 134.
variety tests, 329; Idaho, 732; Iowa, 732; Kans., 427; Ky., 525; Miss., 32, 222, 428; Mont., 129; Ohio, 733; Tex., 429; U.S.D.A., 630; Wash.Col., 224.
yellow v. white—
as stock feed, 265.
for pigs, Nebr., 775, Wis., 672.
yields, La., 824.
yields under livestock and grain systems, S.Dak., 528.
zebra striped leaves, inheritance, 632.
Corncobs, furfural manufacture from, optimum conditions, 507.
Cornell University, notes, 299, 698, 900.
Cornstalks, carbohydrates, effect of desiccation methods, 10.
Correlations, mathematical basis for calculating, 175.
Corrosive sublimate—
for bean seed treatment, 841.
for potato seed treatment, 47; Idaho, 746.
treatment of barley, tests, 840.
value against cabbage maggot, 557.
Corticium—
javanicum, notes, 540.
vagum, pathogenicity as affected by soil temperature, 347.
vagum solani, notes, 843.
Corythucha gossypii, control, V.I., 352.
Cost determination, problem of interest and rent in, 487.
Cost of living and rural cooperation in Belgium, 895.
Cost of production data, N.Y.Cornell, 691.
Cost of production, studies, Can., 734.
(*See also specific crops.*)
Cottage building in England, cost, 689.
Cotton—
aphid, control, V.I., 352.
Arizona wild, distribution, Ariz., 558.
as affected by—
borax in fertilizers, 217; U.S.D.A., 325.
sulphur, 33.
boll cutworms, control, V.I., 352.
boll shedding, cause, N.C., 747.
boll weevil—
control, U.S.D.A., 659.
control methods, 255.
dispersion in 1922, U.S.D.A., 156.
dusting for, U.S.D.A., 558.
notes, 758; N.C., 757.
Philippine, notes, 156.
summary, Okla., 558.
wild, distribution, Ariz., 558.
bollworm, control, V.I., 352.
bollworm, notes, 758.
bollworm, pink—
control, V.I., 352.
in Belgian Kongo, 759.
in Porto Rico, 550.
in South India, 556.
notes, 758.
review of literature, 254.
botanical research in Egypt, summary, 131.
breeding experiments, 535; Miss., 225, 428; Tex., 429.
bud and boll shedding, 842.
countries of world, statistics, 32, 529.
culture and irrigation on Niger, 82.
culture experiments, Miss., 225, 428; Tex., 429.
culture in Ilorin Province, 734.
culture in various countries, 331.
demonstrations, results, La., 890.
dusting experiments, Ga., 524.
dusting machinery, U.S.D.A., 590.
effect on phosphatic fertilizers, 726.
examination of characters in, methods, 228.
experiments, 131.
fertilizer experiments, Ga., 524; Miss., 222, 225, 330, 428; Okla., 428.
germination, effect of fertilizers, 122.
gins, grounding to prevent fires, U.S.D.A., 590.
hail-damaged, notes, Tex., 429.
hair—
destruction by microorganisms, 646.
removing surface liquids from, 132.
rigidity, 131.
structure and botanical aspects, 521.

Cotton—Continued.
improvement, N.C., 733.
in current literature, 131.
Indian, types, 131.
industry, summary, 528.
infested by boll weevil, condition of plants, U.S.D.A., 432.
insect pollination, U.S.D.A., 227.
insects affecting, V.I., 352.
insects affecting—
in Anglo-Egyptian Sudan, 758.
in South Wales, 758.
lace-bug, control, V.I., 352.
Pima, self-fertilization and cross-fertilization, U.S.D.A., 226.
Pima, summer irrigation, 330.
position in American agriculture, U.S.D.A., 389.
production in Missouri, 228.
production, statistics of 1921–22, 228.
raw, testing for humidity, 331.
research in British Empire, 398.
rôle in economic progress and international trade, 94.
root rot in Arizona, 246.
root tips, excised, cultivation under sterile conditions, 627.
rotation experiments, Tex., 429.
seed from several sources, Tex., 429.
seed fumigation, 154.
(*See also* Cottonseed.)
soils of middle Niger, analyses, 616.
sore shin, studies, 842.
spacing experiments, Miss., 222, 226; Tex., 429.
spinning tests, U.S.D.A., 331.
stainer, control, V.I., 352.
stainers, notes, 758.
stalks, green, palatability of silage from, Ga., 524.
supply, distribution, and consumption, 331.
the universal fiber, 528.
thinning and spacing, Ga., 524.
time of thinning, Tex., 429.
trade, Federal Trade Commission report, 693.
varieties, Miss., 330.
varieties, sap properties, 24.
varieties, spinning tests, U.S.D.A., 33.
variety tests, Guam, 427; Miss., 222, 225, 428; N.Mex., 525; Okla., 428, 432; Tex., 429.
water supply, relation to maturity, 842.
weather damage tests, U.S.D.A., 33.
wilt, a seed-borne disease, 246.
wilt, cause, 648.
yields, La., 824.
yields, effect of thinning, N.C., 733.

Cottonseed—
absorption of hydrocyanic acid by, U.S.D.A., 457.
cake, feeding value, Nebr., 671.
feeding value, Tex., 469.
hulls, feeding value, N.C., 773.
meal—
effect on reproduction in animals, N.C., 773, 780.
feeding, tissue changes from, 178.
feeding value, 69, 465; Ind., 267; Iowa, 774; Miss., 267, 869; N.C., 773; N.Mex., 868, 869; Tex., 469; Wyo., 867.
fertilizing value, 834; Tex., 436.
v. tankage for laying hens, Tex., 470.
v. velvet beans for cows, Miss., 471.
oil for motor fuel, 590.
oil, losses in refining, 311.

Cottonwood trees, chlorosis of, N.Mex., 548.

Country newspaper, treatise, 595.
(*See also* Rural.)

County agent and extension specialist, responsibility, 492.

Couturea phalaridis n.sp., description, 445.

Cover crops for apples, Mont., 136.

Cover for orchards, Wash.Col., 232.

Cow manure with wood ashes, fertilizing value, 516.

Cowpea—
bacterial spot, studies, 246.
chlorosis, effect of excessive lime, 517.
seeds, manganese content, 731.

Cowpeas—
and corn, hogging-down, La., 272.
and corn, intertillage, Tex., 429.
as chinch bug control crop, Ill., 431.
culture experiments, Tex., 429.
fumigated, hydrocyanic acid absorption and retention by, U.S.D.A., 456.
variety tests, Guam, 426; Tex., 429; Va., 134.
yields, La., 824; Ohio, 733.

Cowpox and chicken pox, relation, 379.

Cowpox virus, studies, 378.

Cows—
aborting, time data, Ky., 581.
calcium balance, 779.
cost of production, N.Y.Cornell, 691.
dairy, competition, Calif., 275.
feeding and management, 375.
feeding experiments, Ga., 578; Idaho, 778; Miss., 471; Mont., 172; Pa., 472.
feeding for winter milk production, 874.
feeding, principles, 675.
feeding without silage, 780.
Friesian, correlation between milk and fat, 677.
growth rate, 374.
milk production. (*See* Milk production.)
minimum of rough fodder in rations, 780.
on pasture, feeding grain to, value, Oreg., 578.
pasturing experiments on Sudan grass, Kans., 472.

Cows—Continued.
purebred, stock breeding farms for, 374.
rations, succulence in, West.Wash., 375.
shape of lactation curve, 876.
sterility in, West.Wash., 97.
udders. (*See* Udder.)
wide and narrow rations for, Ohio, 375.
winter feeding, cod liver oil for, 780.
(*See also* Calves, Cattle, *and* Heifers.)
Crab apples, breeding, S.Dak., 533.
Crambus—
mutabilis, summary, 656.
praefectellus, studies, 655.
Cranberries—
cause of losses, Wash.Col., 241.
growing in Massachusetts, 237.
Cranberry, fireworm, control, Wash.Col., 251.
Cream—
fat, physical condition, effect on butter, 74.
pasteurization, 276, 699.
rising power in milk of different breeds, 781.
tests, cause of variation, 475.
tests, methods of reading, 805.
Creameries, improving, Wis., 690.
Creamery—
and tester's license law, Ky., 275.
butter, cold storage holdings, U.S.D.A., 893.
license division, report, Ind., 878; Ky., 276.
Creatin—
and creatinin, reciprocal transformation 560, 613.
determination in muscle tissue, 613.
determination, standards for, 612.
Creatinin—
and creatin, reciprocal transformation, 560, 613.
determination in blood, 113.
determination, standards for, 612.
origin in the body, 560.
Creosote, insecticidal value for nursery stock, 451.
Creosote, value for electric line poles, 485.
Cresol soap solutions, cresol content, 410.
Cresol, use for detecting sugar in condensed waters, 408.
Cress, hoary, eradication, 831.
Cress, nickel and cobalt in, 520.
Crested wheat grass, culture experiments, Mont., 430.
Cricket, life history, enemies, and control, S.Dak., 549.
Cricket, Mormon, control, Colo., 450.
Cronartium ribicola. (*See* White pine blister rust.)
Crop—
acreage, controlling, 89.
diseases in England and Wales, 645.
plants, root development and absorption in, 29.
Crop—Continued.
production—
in Ohio, labor requirement, 189.
in Saskatchewan, 894.
studies under dry farming, Nebr., 527.
reports, U.S.D.A., 90, 294, 390, 594, 693, 793, 892.
reports, use by farmers, 90.
rotations. (*See* Rotation of crops.)
yield and weather in Scotland, 115.
yields under legume treatment, 725.
Crops—
as affected by borax, U.S.D.A., 324.
growth, relation to—
alkali content of soils, 513.
soil microorganisms, 514.
soil reaction, 619.
quality, effect of soil conditions, Mich., 419.
(*See also* Field crops *and specific crops.*)
Crossing, effect on evolution of races, 821.
Crown gall disease, studies, Wis., 645.
Crown gall, notes, Oreg., 546.
Crucifer clubroot, notes, 44.
Crucifer hybrid, nodosities on roots, 820.
Cruciferous oil-crop pests, control, 252.
Crude fiber. (*See* Cellulose.)
Ctenocephalus felis, transmission of surra by, 158.
Cucumber—
anthracnose under glass, control, 146.
beetle, striped—
color markings and powers of flight, 854.
control, U.S.D.A., 454; Wis., 653, 760.
paper on, Mich., 495.
mosaic, notes, Iowa, 746.
mosaic, overwintering, Wis., 644.
mosaic, transmission to other hosts, 646.
skin, vitamin A in, 769.
wilt, cause, 648.
Cucumbers—
culture, Mont., 136.
fertilizer experiments, Ohio, 337.
in glasshouses, mycetophilid flies attacking, 254.
production in greenhouses, U.S.D.A., 436.
soil sterilization experiments, 741.
spraying and dusting experiments, Va. Truck, 233.
Cucurbit—
mosaic, cross-inoculation studies, 646.
pollen germination, Iowa, 731.
Cucurbits, effect on following crop, 231.
Culex quinquefasciatus, notes, 657.
Culicidae, classification, evolution of, 400.
Cultivation, Jean method, results, 812.
Cultivator, pulverizing rotary as substitute for plow, 86.
Cultivators, tests, 486.
Cupressus lawsoniana, value as shelterbelt tree, 240.

Currant—
anthracnose, control, Oreg., 547.
aphid, notes, Oreg., 555.
borer, notes, Oreg., 555.
die-back, control, Oreg., 547.
fruit-fly, notes, Oreg., 555.
mite, black, effect of sulphur on, 660.
powdery mildew, control, Oreg., 547.
rust in British Columbia, 150.
silver-leaf, notes, 845.
worms, notes, Oreg., 555.
Currants—
black, reverted, leaf character in, 649.
black, ringing experiments, 40.
culture, Mont., 136.
culture experiments, Alaska. 435.
insects affecting, Oreg., 555.
Nectria cinnabarina affecting, 649.
pot-grown, fertilizer experiments, 833.
time of fruit bud differentiation, 834.
Cut-over—
land, second growth on, Minn., 439.
redwood lands, agriculture in, Calif., 90.
Cuttings, propagation in acidic media, 835.
Cutworm—
black, notes, 758.
pale western—
control, Mont., 152, 251.
forecasting outbreaks, 155, 759.
meteorological relations, Minn., 759.
Cutworms—
affecting cotton, 758.
control, Mont., 152.
notes, N.Mex., 554.
Cyanamid, determination, 505.
Cyanid. (*See* Hydrocyanic acid.)
Cyarda sp., notes, 550.
Cylas formicarius. (*See* Sweet potato weevil.)
Cylicostomum in horses, 256.
Cylindrosporium juglandis, notes, N.C., 747.
Cystein, derivatives of, 501.
Cysticercus, fasciolaris, biology of, 76.
Cystin, determination in albumin, 503.
Cystin, derivatives of, 501.
Cytosporina citriperda, n.sp., description, 150.
Dahlias, discovery of ancestral form, 141.
Dairy—
bacteria, controlling, 599.
barns, diagrams, 175.
chemistry, notes, 376.
Congress Association, World's, 277.
Congress, World's, editorial, 601.
control, 276.
cows. (*See* Cows.)
farm organization, Wash.Col., 291.
farming, manual, 778.
farms, business analysis, Idaho, 88.
farms, inspecting, U.S.D.A., 878.
industry, world's, principal events, 675.
manufacturing plants in Michigan, list, 879.
Dairy—Continued.
power and heat for, in Germany, 84, 85.
products, bacteriological studies, Iowa, 781.
sires. (*See* Bulls *and* Sires.)
special, transcontinental, 100.
Dairying—
adaptation for, Miss., 222.
experiments, Fla., 874; Okla., 475; Wis., 679.
in Alberta, reconstruction, 73.
in Canada, statistics, 75.
in New York State, 177.
in South Africa, guide, 474.
in South Australia, 166.
in United States, U.S.D.A., 390.
in Vermont, historical review, 675.
instruction in, 96.
methods, 276.
treatise, 778.
(*See also* Creamery, Butter, Milk, *etc.*)
Dairymen's—
Association and Dairy School of Quebec, report, 778.
manual, 376.
Daisy, Michaelmas disease, 45, 50, 250.
Daisy disease, cause, 250.
Dams, earth, design, 587.
Dams, failures, 383.
Darso silage. (*See* Silage.)
Darso, variety tests, Okla., 428.
Dasyneura leguminicola, new parasite on, 157.
Datura mutants, causes of sterility, 24.
Datura stramonium, breeding experiments, Wis., 630.
Daulis ferruginea, notes, 550.
Delaware Station, notes, 98, 396, 600.
Delaware University, notes, 396, 600.
Delphinium spp., chemical examination, Wyo., 476.
Dengue fever, etiology, 657.
Department of Agriculture. (*See* United States Department of Agriculture.)
Dermanyssidae, keys and descriptions, 455.
Derris elliptica extracts, insecticidal value, 152.
Desert—
Egyptian, bioclimatic study in, 208.
soils of State of Kapurthala, reclamation, 323.
watering places in Arizona, routes to, 383.
Desiantha nociva, control, 761.
Desmodium, agricultural value, 34.
Dewberry-raspberry hybrid, renamed, Tex., 435.
Dewberry rot, origin of cavities in pycnidia, 349.
Dextrose solution, effect on bud growth of cuttings, 834.
Diabetics, nature of blood sugar of, 715.
Diabrotica vittata. (*See* Cucumber beetle, striped.)
Diaeretus rapae, larval stages, 559.

Diaprepes abbreviatus, control, V.I., 352.
Diarthronomyia hypogaea, notes, 56.
Diastase solution, effect on bud growth of cuttings, 834.
Diastatic ferments, effect on flour strength, 12.
Diatraea saccharalis. (*See* Sugar cane borer.)
Dicera pecterosa, notes, Oreg., 555.
Dictionary of fertilizer materials, 422.
Diet—
accessory factors. (*See* Vitamins.)
acid and base, effect on urine composition, 764.
deficiency diseases. (*See* Beriberi, Pellagra, Polyneuritis, Rickets, *and* Scurvy.)
deficient, effect on blood, 565.
of children. (*See* Children.)
of infants. (*See* Infants.)
planning, Ark., 364.
proportions in, U.S.D.A., 158.
restricted, effects, 458, 766.
rickets inducing, acid base ratio, 65.
vegetarian, effects on growth and reproduction, 458.
vitamin A deficient, effect on blood platelets, 61.
(*See also* Food *and* Nutrition.)
Diethyl red, usefulness as reagent, 520.
Diets, synthetic, for nutrition of pigeons, 160.
Dinemasporium graminum, description, 445.
Diphtheria—
antitoxin, rate of disappearance in rabbits, 478.
avian, etiology and treatment, 482.
avian, studies, 81.
Diplocladium theobromae, notes, 540.
Diplodia gumming, notes, Calif., 649.
Diplodia—
natalensis, temperature relations of growth, 540.
sp., notes, 839.
tubericola, notes, Tex., 442.
zeae in seed corn, 243.
zeae, notes, 542; Iowa, 746; Ohio, 346.
zeae, tests, Ind., 580.
Diplodinula phalaridis n.sp., description, 445.
Diprion simile, notes, 855.
Dipsacus laciniatus, leaf-base troughs, reaction of, 520.
Dipterocarpus spp., properties and uses, 43.
Discella cacaoicola, notes, 540.
Diseases—
of animals. (*See* Animal diseases *and specific diseases.*)
of plants. (*See* Plant diseases *and specific host plants.*)
of the nervous system, interpretation, 178.
tropical, 499.
Disk harrows, studies, Iowa, 788.
Ditches, drainage and irrigation. (*See* Drainage *and* Irrigation.)
"Djati" forest soils of Java, studies, 16.
Dodder, prevalence in Great Britain, 530.
Dogs—
breeding and care, treatise, 373.
internal parasites, treatment, 684.
parasitic, infestation before birth, 684.
rickets in, Wis., 664:
Dogwood, twig growth, 128.
Dolerus haematodis, notes, 256.
Domestic science. (*See* Home economics.)
Donkeys, blood of, 683.
Douglas fir, decay in, U.S.D.A., 755.
Douglas spruce, culture in Australia and New Zealand, 837.
Dourine—
diagnosis, Bordet-Gengou reaction in, 481.
heredity transmission experiments, 179.
in horses, preventing infection, 683.
treatment, 179, 400.
Drainage—
and improvement of soils, Oreg., 510.
and improvement of white land, Oreg., 588.
assessments, imposition and collection in North Carolina, 887.
benefits, 384.
ditches, construction, explosives for, 483.
ditches, open, design, 588.
effects on alkali salts and plant-food constituents, N.Mex., 886.
land, economics of, 886.
of seeped lands, studies, Mont., 184.
projects, economics of, 384.
studies, Wis., 686.
tile, cost and value of improved lands, 685.
waters, sulphur lost in, 727.
Draintile—
concrete, effect of organic decomposition products, 790.
studies, Wis., 686.
Driers, construction, U.S.D.A., 411.
Driers, recirculation, Oreg., 388.
Drosera rotundifoli, glandular secretion, acidity, 520.
Drosophila—
duration of life in, 568.
heterozygous, omnatidial number, temperature factors, 266.
inheritance of duration of life in, 667.
interaction between closely linked lethals in, correction of error, 770.
Drosophila—
hydei, inheritance of two sex-linked characters, 368.
melanogaster, effect of selection on Mendelain ratio of the eye and eyeless, 769.
melanogaster, new mutations in an inbred strain, 770.

Drought—
in Russia in 1921, 209.
Investigation Commission, Union of South Africa, 192.
relation to production, 808.
Droughts, forecasting, 509.
Drug plants, present and potential production in French colonies, 389.
Drugs, microscopic examination, manual, 12.
Drugs, use to stimulate milk production, Iowa, 779.
Drumlins, mapping, 616.
Dry cells, electrical characteristics and testing, 184.
Dry farming at Scottsbluff Substation, Nebr., 527.
Drying. (*See* Fruits, evaporation.)
Duck disease, toxic anaerobe from, 382.
Ducks—
North American, life histories, 756.
raising in Argentina, 171.
spontaneous disease of, 684.
trap nesting, 374.
trematode parasites of, 183.
wild, migratory movements, U.S.D.A., 351.
Dusting—
and spraying for citrus pests, 654.
machine, self-mixing, Calif., 287.
machines for boll weevil control, U.S.D.A., 558.
v. spraying, 442.
v. spraying—
for pear psylla, N.Y.State, 52.
for potato blight, R.I., 544.
results, Conn.State, 534.
vegetable crops, Va.Truck, 233.
(*See also* Spraying *and specific plants.*)
Dusts, explosive, in air, collection and examination, 387.
Duty of water. (*See* Irrigation.)
Dyes, acid, absorption by activated sugar charcoal, 505.
Dysdercus—
sidae, notes, 758.
suturellus. (*See* Cotton stainer.)
Dysentery, bacillary in lambs, etiology and source of infection, 682.
Ear tick disease—
review of literature, 455.
studies, 157.
Earth pressure, lateral, determination, 484.
Earthworms, effect of soil reaction, 213.
Earwig, European—
control, West.Wash., 850.
poison baits for, 850.
Echeveria carunculata, nodosites in, 820.
Echidnophaga gallinacea, notes, 356.
Echinostomum revolutum, life history, 183.
Ecology, studies on, 28.
Economic and commercial prospects of Italy, year book, 693.
Economic condition in Russia, 693.
Economics, rural. (*See* Rural economics.)
Edessa offinis, notes, 550.
Edestin, new sulphur-containing amino acid from, 714.
Education—
agricultural. (*See* Agricultural education.)
vocational. (*See* Vocational education.)
Educational extensions, 796.
Educational surveys, 796.
Egg—
albumin. (*See* Albumin, egg.)
by-products from hatcheries, utilization, Ohio, 373.
production—
and trade, 376.
as affected by artificial light, Can., 71; Ind., 573; Ky., 574; Okla., 470.
feeding for, Mo., 574.
improving, Mont., 171.
monthly distribution, relative value, 674.
pedigree basis of selecting breeding males for, 873.
relation to food, 171.
wet v. dry mash for, 171.
(*See also* Hens, laying.)
Eggplant wilt, cause, 648.
Eggplants, spraying, Va. Truck, 233.
Eggs—
as source of vitamin B, 161.
chilled, incubation, Can., 70.
cold-storage holdings, U.S.D.A., 893.
dried, industry in China, 507.
early laying, economic significance, 674.
handling and grading, 273.
hatchability as affected by rations, Kans., 470; Wis., 672.
New York City prices, effect on poultry raisers, N.J., 172.
of parasitic worms, detection in animal feces, 785.
preservation, studies, Mont., 874.
preserving, methods, Mont., 471.
prices and cold storage holdings, N.J., 794.
specific gravity, effect on fertility and hatching power, 373.
studies, Idaho, 777.
surface area, calculating, 274.
winter production, Ohio, 273.
Eimeria brumpti n.sp., notes, 182.
Electric power systems of California, 383.
Electric range handbook, 589.
Electrical—
conductivity of ligneous and herbaceous plants, 26.
engineering, standard handbook, 483.
Electricity—
in agriculture, treatise, 589.
Swoope's lessons in, 286.
v. steam power for dairy operation, 84, 85.
Electroculture, 224.
Electroscope for measuring radioactivity of fertilizers, 217.

Eleodes—
hispilabris, control, Idaho, 756.
opaca, studies, Nebr., 658.
tricostata, notes, Ark., 554.
Eleusine coracana, smut affecting, 839.
Elfin forest of California, 837.
Elm scale, European, distribution, 758.
Elytroteinus subtruncatus, notes, 56.
Emmer, yields, Ohio, 733; Pa., 223.
Emphysema, enteromesenteric bullular, of pigs, 284.
Empoa rosae, notes, 654.
Empoasca mali. (*See* Apple leafhopper *and* Potato leafhopper.)
Emulsions and emulsification, theory, treatise, 109.
Encephalocele of baby chicks; N.C., 787.
Endocarditis, valvular, in man and animals, 279.
Endolimax nana, notes, 477.
Energy expenditure of school children, 762.
Energy requirements of nodule bacteria, 812.
Engineering—
agricultural, studies, Iowa, 788.
college executive, problems, 492.
construction costs, handbook, 184.
course, ideal, 596.
economics, treatise, 483.
education, improvement, 596.
experiment station, organization, 596.
experiment stations—
at land-grant colleges, status, 596.
history, 492.
highway, research projects in, 184.
in Wyoming, 483.
instruction, improving, 492.
on the farm, treatise, 482.
research, progress in, 492.
State, in Colorado, 383.
Engines—
farm, management, treatise, 589.
gas and gasoline. (*See* Engines, internal combustion.)
internal-combustion—
carburetion of gasoline and kerosene in, 85.
coal tar as source of fuel, 590.
mean effective pressures, 485.
use of oxidized oils in, 387.
tractor. (*See* Tractor engines.)
Enteritis, infectious, of poultry, 482.
Enterohepatitis, infectious. (*See* Blackhead.)
Entomological Record, 848.
Entomology—
economic, in Mozambique, 848.
economic, in Switzerland, 448.
Indian, list of publications on, 849.
(*See also* Insects.)
Enzyms, digestive, effect in avitaminosis, 161.
Ephedrus incompletus, larval stages, 559.
Epidapus scabiei, notes, 254.
Epilachna corrupta—
control, N.C., 757.
new parasitic fly from, 453.
studies, N.Mex., 553.
Epilachna 28-punctata, notes, 758.
Episimus tyrius n.sp., description, 760.
Epithelioma, contagious in pigeons, relation to faulty nutrition, 885.
Epitrix cucumeris. (*See* Potato flea-beetle.)
Epochra canadensis. (*See* Currant fruit-fly.)
Ericaceae, mycorrhiza in, 424.
Ericaceae, nitrogen fixation in, 522.
Ericales, relations in, 424.
Ericerus pela, studies, 355.
Eriophyes gossypii, control, V.I., 352.
Eriosoma lanigerum—
habits in Virginia, 451.
immunity of apple stocks to, 655.
Ernestia ampelus, studies, 555.
Erysiphe taurica, notes, 45.
Erythroneura comes, effect on sugar content of grapes, 850.
Erythroneura tricincta, notes, 654.
Ether in alcohol-ether mixtures, determination, 114.
Ethyl alcohol, substitutes for, Wis., 611.
Ethylite as motor fuel, 590.
Eucosminae, revision, 254.
Eugenics—
international exhibition of, 568.
papers on, 567.
Eulia velutinana, control, Pa., 251.
Eupatorium urticaefolium—
feeding tests, Ind., 580.
poisonous to livestock, Ind., 584.
Euphorbia rusts, seed carriage of, 442.
Euphyllura arbuti, life history, 252.
Euproctis chrysorrhoea. (*See* Brown-tail moth.)
Eustrongylus gigas, anatomical lesions caused by, 177.
Euthrips tritici. (*See* Flower thrips.)
Euzenilliopsis diatraeae, notes, La., 848.
Evaporation of fruits, U.S.D.A., 411.
Evolution by mutation, 567.
Evolution factors, 821.
Ewes—
breeding, feeding experiments, Mont., 168; Wyo., 467.
breeding, wintering, 670; Iowa., 773; Ohio, 269; Okla., 467.
Corsican, milk of, 175.
feed requirements, 67.
reproductive qualities, effect of cottonseed meal, N.C., 773.
(*See also* Sheep.)
Exanthema, notes, Calif., 649.
Exochilum mundum, notes, 555.
Experiment—
farms, county, in Ohio, reports, Ohio, 792, 798.
station—
of Central Institute, Sweden, guide for visitors, 527.

Experiment—Continued.
station—continued.
position in college of agriculture, 492.
relation to graduate work, 596.
work, relation to extension program, 492.
stations—
future, 596.
in Finland, 399.
in middle life, paper on, 491.
laws concerning, U.S.D.A., 195.
list of workers in agriculture, U.S.D.A., 492.
organization and policy, 709.
projects, classified list, U.S.D.A., 898.
work and expenditures, U.S.D.A., 897.
(*See also* Alabama, Arizona, *etc.*)
Experimental fields, establishing, soil type as basis, 616.
Explosives—
strength, effect of cartridge diameter, 83.
use in farm drainage, 483.
Extension work. (*See* Agricultural extension.)
Eye defects, inheritance, 567.
Fairs, community and county, suggestions for, 96.
Farcy. (*See* Glanders.)
Farm—
accounting, 292.
accounting—
for income tax purposes, 692.
objectives in, 591.
on successful farms, N.Y.Cornell, 690.
animals. (*See* Livestock *and* Animals.)
buildings, plan and construction, 487.
capital and profits, 792.
credit. (*See* Agricultural credit.)
devastated, in France, restoration, 292.
engines, management, treatise, 589.
equipment, increase in value, division between landlord and tenant, 892.
fertility, treatise, 510.
financing and business prosperity, 190.
homes and land tenure, Nebr., 189.
homes, living conditions, Nebr., 595.
homes, plans, Wis., 689.
household management instruction in Belgium, 797.
implements, draft, Iowa, 788.
improvements, assignment of value at time of change in contract, 891.
labor. (*See* Agricultural labor.)
machinery. (*See* Agricultural machinery.)
management, Ky., 592.
management—
in Gallatin Valley, Mont., 188.
in Ontario, 592, 593.
in Saskatchewan, 894.
Farm—Continued.
management—continued.
on dry land areas, Mont., 188.
recitation in, 797.
surveys, data from, Miss., 488.
market, importance, 190.
meats, treatise, 570.
mechanics, treatise, 284.
mortgage financing, treatise, 594.
organization, Ind., 592.
organization of Roye in Santerre, 489.
population studies to be conducted, 492.
practice work, supervised, State program for, 492.
products. (*See* Agricultural products.)
shop work, course of study, 195.
stock-taking, 692.
tenancy. (*See also* Land holdings, Land tenancy, *and* Land tenure.)
timbers, treatment, Mont., 184.
Farmer and town, service relationships, Wis., 690.
Farmers—
annual excursion to the station, 599.
income of, 290.
organizations, experiences with politics and legislation, 295.
use of crop reports by, 90.
Farming—
dairy. (*See* Dairy farming.)
diversified, value, Wis., 690.
mixed, and apple growing in Ontario, 592, 593.
occupations, vocational education in, treatise, 493.
on hills of England and Wales, treatise, 491.
plans for Piedmont section of Georgia, 189.
policy and commodity prices, 692.
systems for south Georgia, 189.
types in United States, U.S.D.A., 592.
types, relation to types of tenancy, Iowa, 793.
(*See also* Agriculture.)
Farms—
business analysis, Idaho, 88.
changing conditions on, 195.
Corn Belt, motor trucks on, U.S.D.A., 185.
outlet drains for, Wis., 285.
owned v. tenant, Wis., 690.
successful, cost data, N.Y.Cornell, 690.
Fasciola hepatica infection, complement fixation reaction in, 77.
Fat—
content of human milk, 275.
content of milk, inheritance, 877.
extraction test, denatured alcohols for, Wis., 611.
in casein, analyzing and removing, 609.
in casein, determination, 609.
Fats—
analysis treatise, 608.
and carbohydrates in nutrition, 362.
animal, factors affecting composition, Kans., 464.
antiscorbutic factor in, 58.

Fats—Continued.
digestibility, 560.
effect on elimination of endogenous uric acid, 662.
effect on nitrogen distribution in urine, 257.
proteins, and carbohydrates, unusual proportions in diet, effect, 360.
rancidity in, characteristics and causes, 410.
shortening powers, 455.
vegetable, coefficients and digestibility, 560.
vegetable, vitamin A content, 59.
(*See also* Oils.)
Fat-soluble A. (*See* Vitamin A.)
Fatty acid-glycerin mixture, predominance in diet, effects, 359.
Fatty acids, determination in butter fat, 678.
Feather mite, notes, 848.
Feathers and feather pigments, morphology, 574.
Feed—
cost of milk and fat production, Ill., 576.
flour, standards for, 65.
unit, Scandinavian, 72.
units, significance in determining value of feeding stuffs, 166.
Feeding experiments. (*See* Cows, Pigs, *etc.*)
Feeding stuffs—
analyses in New York, 167.
analyses in Ohio, 66.
Bacillus botulinus in, 860.
Canadian, for beef production, Can., 67.
commercial, feeding value, Iowa, 572.
commercial v. home mixtures for pigs, Can., 68.
composition, relation to milk production, N.Y.Cornell, 577.
definitions, 66.
determining value, 166.
digestion experiments, errors in, 864.
inspection, Ind., 771; R.I., 370.
inspection and analyses, 66.
law of diminishing returns, application, 89.
manufactured, 66.
vitamins in, importance, 265.
Fence posts, concrete, studies, Iowa, 788.
Fence posts, durability, Mich., 84.
Ferments. (*See* Enzyms.)
Ferns, polyembryony in, 425.
Fertilizer—
complete, fertilizing value, 834.
experiments, 516, 814, 834; Ohio, 724; Pa., 214.
(*See also special crops.*)
handbook, American, 422.
industry in Germany, regulations, 819.
industry in Sweden, 727.
inspection law, Me., 218.
inspection law of Michigan, 422.
law of Canada, 125.
law of Kansas, Kans., 518.
Fertilizer—Continued.
laws of Spain, 214.
registrations in New Jersey, N.J., 422.
requirements of soils. (*See* Soils.)
studies with composts, Ga., 516.
Fertilizers—
action and time of application, 517.
analyses, 218; Me., 218; Mo., 23.
analyses in Florida, 218.
and land values, 792.
composition and prices, N.Y.State, 325.
composition and use in Spain, 214.
effect on sulphur and phosphorus in tomatoes, 436.
experiment station research in, 105.
for lawn and garden, West.Wash., 97.
for spring crops, Mich., 19.
from city refuse, 215.
inspection and analyses, Conn.State, 124; Kans., 518; N.J., 325.
inspection and analyses—
in Arkansas, 818.
in California, 727.
in Indiana, Ind., 727.
in Michigan, 422.
in Ohio, 124.
law of diminishing returns, application, 89.
methods of applying, Wis., 622.
New England Standard Nine, use in Massachusetts, 726.
new, experiments, 623.
nitrogenous. (*See* Nitrogenous fertilizers.)
phosphatic. (*See* Phosphates.)
potash. (*See* Potash.)
radioactivity of, measuring, 214.
sampling and analysis in Spain, 214.
selection, purchase, and use, Mo., 23.
studies, Miss., 414.
value, Iowa, 723.
value, unit method of estimating, 737.
Fescues, culture experiments, 735.
Fiber, crude. (*See* Cellulose.)
Fiber in swine ration, effect, Ohio, 371.
Fiber plants, breeding experiments, 735.
Field crops—
manual, 31.
new forms, multiplication and distribution, 130.
teaching, 194.
varieties for dry land and irrigation, Oreg., 526.
work in Bengal, 734.
work in India, 31, 526.
work in Ireland, 329.
work in New South Wales, 329.
work in Nigeria, 31, 734.
work in Tunis, 31.
(*See also* Crops, Forage crops, Root crops, *etc.*)
Field—
experiments, unavoidable error in, 823.
husbandry, cooperative experiments, 825.
notes, outlines and systems of collecting, 616.

Figs, insects affecting, 448.
Fiji disease—
eradication, 444.
galls, organism in, 444.
lemon weevil, notes, 56.
Filberts, pollination studies, Oreg., 532.
Filter press waste, fertilizing value, 23.
Filtration, treatise, 202.
Finger prints, statistical investigation, 567.
Fire blight in orchards, control, 149.
Firewood. (*See* Wood.)
Fish, cold storage holdings, U.S.D.A., 893.
Fish conservation laws of Maryland, 250.
Fish liver oils, sulphuric acid test for, 611.
Fish meal—
as protein supplement for pigs, Mich., 469.
feeding, effect on milk, Fla., 875.
feeding, effect on pork, N.C., 775.
feeding value, N.C., 775.
plants, comparative efficiency, 122.
Fish preservation by freezing, 559.
Fish, vitamin requirements of, 565.
Flat-headed borers, notes, Oreg., 555.
Flavoring materials, natural and synthetic, 114.
Flax—
and kindred fibers, 33.
and wheat as combination crops, Minn., 431.
browning and stem break disease, 543.
culture and harvesting, 132.
culture experiments, Alaska, 426.
culture in Montana, Mont., 432.
disease, new, 45.
diseases in England and Wales, 645.
frost resistance in, U.S.D.A., 332.
in textile industry, 528.
production in United States, statistical study, U.S.D.A., 389.
seeding experiments, Can., 734.
seeds, iron and manganese content, 202.
selection, 228.
varieties, 228.
variety tests, 31, 232; Can., 734; U.S.D.A., 825.
Flaxseed, production, trade, and foreign competition in, 794.
Flies, control, 356.
Flies, house. (*See* House fly.)
Flies, white. (*See* White fly.)
Floods in central Texas, 383.
Floods in Colorado, 383.
Flora. (*See* Plants *and* Vegetation.)
Florida—
Station, notes, 396, 600, 899.
Station, report, 898.
University, notes, 299, 396, 600.
Flour—
and bread making, 660.
and wheat, correlation between characters, 231.
baking tests, 135.
Flour—Continued.
from Indiana wheat, Ind., 257.
fumigated, hydrocyanic acid absorption and retention by, 456.
milling, chemical manual for, 114.
milling tests, 831.
mills, Swiss cooperative, 94.
protein removal from, technique, 110.
strength, chemistry of, 308.
strength, effect of addition of diastatic ferments, 12.
trade of United States, 795.
(*See also* Bread.)
Flower thrips, notes, Ind., 548.
Flowers—
annual and perennial, West.Wash., 97.
culture in California, 438.
(*See also* Plants, ornamental.)
Fluorin compounds, toxic action on plants, 127.
Foals, purebred draft, feeding experiments, Wis., 672.
Fodder crops. (*See* Forage crops.)
Fomes—
annosus, soil conditions affecting prevalence, 447.
lignosus, toxicity of lime to, 518.
spp., notes, 45.
spp., on Douglas fir, U.S.D.A., 755.
Fomes root disease, 45.
Food—
acid and base content, effect on urine composition, 764.
analysis, treatise, 407.
assimilation, effect of vitamins, 159.
chemistry, micro and half micro methods in, 112.
chemistry, treatise, 559.
Chemists, German Society of, 608.
control during 46 centuries, 559.
dietary properties, Ark., 364.
for the family, 56; U.S.D.A., 158.
handlers, medical examination, 559.
preservation by freezing, 559.
preservation, course in, 297.
production in England, treatise, 389.
production in war, treatise, 290.
products, insects affecting, 252.
requirements of school children, 762.
Research Institute, organization and policies, 660.
Research Laboratory in Japan, 499.
value of milk, paper on, 176.
(*See also* Diet.)
Foods—
canned. (*See* Canned vegetables.)
microscopic examination, manual, 12.
perishable, handling, R.I., 91.
vitamin C in, protection, 563.
with specific action, 358, 766.
Foot-and-mouth disease—
control, 179.
immunization, 282.
significance of complement fixation test in, 882.
Forage crop diseases, N.Dak., 343.

Forage crops—
culture experiments, Mont., 430
for pigs, Mont., 170.
leguminous, of Brazil, 34.
tests, 825.
under dry farming, Mont., 430.
value in lower feed costs, Iowa, 373.
variety tests, 31.
Forage—
diseases in England and Wales, 645.
feeding methods, Mont., 170.
poisoning. (*See* Plants, poisonous *and specific plants.*)
Forest—
administration. (*See* Forestry.)
areas, cut-over redwood, agriculture in, Calif., 90.
experiment station, Wind River, activities, 238.
insect control, use of airplane in, Ohio, 352.
litter, fertilizing, 814.
officers of the British Empire, list, 643.
planting experiments, 743.
regulation, American, treatise, 238.
research in India, 745.
resources in Ontario, 838.
resources in Pennsylvania, 42.
seeds and plants, collection and distribution in Hawaii, 143.
seeds, delayed germination, 141.
Service, brush disposal methods, U.S.D.A., 642.
situation in Western Australia, 837.
soils, bacteriological studies, Idaho, 213.
soils, effect of acid carbonate salts, 814.
soils, from Czechoslovakia, biochemical supplies, 511.
soils, in Ceylon, analyses, 617.
soils in Java, 16.
species, germination tests, 745.
species of China, 745.
statistics for several countries, 144.
thinnings, classification, 837.
trees. (*See* Trees.)
Forestation in India, 838.
Forestry—
for profit, 837.
in Baluchistan, 240.
in British Columbia, 838.
in Canada, 837.
in Connecticut, 238.
in Great Britain, 537.
in Hawaii, 143.
in India, 240, 441, 537, 643, 745.
in Indo-China, 42.
in Massachusetts, 441.
in Michigan, 441.
in New South Wales, 342.
in Nigeria, 143.
in Norway, 745.
in Ohio, Ohio, 342.
in Ontario, 838.
in Pennsylvania, 42.
in Uganda, 42.
in Washington, 142.
Forestry—Continued.
international, bibliography, 342.
investigations, N.H., 341.
problems of the United States, U.S.D. A., 341.
projects in Sweden, 42.
research, recent developments, 401.
station at Avondale, work, 743.
survey of Illinois, 341.
Forests—
bog, destruction and replacement, 239.
edaphic limit in prairie region, 439.
in Australia, 440.
national, trespass laws and investigative methods, U.S.D.A., 537.
of Madagascar, notes, 440.
of New England, historical account, 239.
of New York State, treatise, 142.
of north Russia, economic importance, 240.
vanishing in United States, treatise, 341.
yield as affected by thinning, 42.
Forficula auricularia—
control, West.Wash., 850.
poison bait for, 850.
Formaldehyde—
for bean seed treatment, 841.
for potato seed treatment, 47.
for potato treatment, Idaho, 746.
in milk, effect on vitamin content, 459.
sterilization of soil for lettuce drop, 246.
treatment of barley, tests, 840.
Foulbrood, effect of sodium hypochlorite, 156; Wis., 653.
Fowl cholera, summary, Mich., 482.
Fowl mite, tropical, notes, 381.
Fowler's solution, toxic dose for dogs, 381.
Fowls—
close inbreeding in, effects, Conn.-Storrs, 575.
vaccination against chicken pox, 183.
wild, conservation laws of Maryland, 250.
(*See also* Chickens, Hens, Poultry, *etc.*)
Fox farming, history and common practices, U.S.D.A., 471.
Foxes, management and feeding, Wis., 675
Foxes, parasites of, treatment, 382.
Foxtail millet, life history, 528.
Frankliniella occidentalis, notes, 850.
Frankliniella tritici, notes, 848.
Freezing, effect on autolysis of meat, 11.
Fringed nettle grub, notes, 455.
Frost—
protection by artificial clouds, 615.
protection in Sao Paulo, 315.
resistance in flax, U.S.D.A., 332.
Fruit—
beverage investigations, Calif., 412.
breeding experiments, S.Dak., 533.
bud formation date, 834.
bud formation, effect of shading and ringing, N.H., 742.
bud formation studies, 833; Oreg., 532.

Fruit—Continued.
bud production, factors affecting, 48.
diseases in England and Wales, 645.
diseases in field and during transit, 845.
diseases in New York State, 442, 445.
farms, business analysis, Idaho, 88.
fly on jujube, 849.
growing in North Carolina and temperature belts, U.S.D.A., 314, 337.
growing in Ontario, 592, 593.
growing treatise, 37.
jellying, rôle of acids in, Del., 9.
pests, common but unfamiliar, 599.
production and trade, 376.
tree leaf roller—
control, Mont., 152, 251, 852.
notes, Idaho, 756.
summary, Mont., 254.
tree leaf scorch, 48.
tree rootstocks, identification, Calif., 637.
trees—
blooming and ripening dates, climatic effect, N.Y.Cornell, 338.
dwarf, studies, Wis., 644.
fertilizer experiments, 833.
pruning experiments, N.Y.Cornell, 637.
ringing and notching experiments, 833.
root development, 235.
Fruits—
Bacillus botulinus in, 860.
Brazilian, possible adaptation in Florida, 140.
breeding experiments in Ontario, 436.
canned, oxygen and perforations in, 856.
citrus. (*See* Citrus fruits.)
culture, Can., 832.
evaporation, U.S.D.A., 411.
for storage, time of harvesting, Iowa, 740.
fumigated hydrocyanic acid absorbed by, U.S.D.A., 456.
fungus diseases, control, 540.
handling and drying, Oreg., 742.
importance as food, 364.
new or noteworthy, N.Y.State, 338.
oriental, antiscorbutic vitamin in, 563.
parasitic diseases, in Washington, 445.
pectic substances of, 48.
preserved, acids of, 112.
small, diseases, notes, Oreg., 546.
small, insects affecting, summary, Oreg., 555.
small, mosaic affecting, Oreg., 755.
sources of new varieties, West.Wash. 395.
spraying directions, Ill., 338.
sterility in, experiment station research in, 104.
storage experiments, 437.
thinning, 599; Calif., 235.
tropical, notes, Guam, 435.
(*See also* Orchards, Apples, Peaches, *etc.*)
Fuel—
consumption of tractors, 792.
consumption studies, 888.
for motor transport, 185.
of varied volatility for motor vehicles, tests, 386.
wood situation, 239.
Fuels, engine, acetone in, 888.
Fumigation—
of citrus trees, U.S.D.A., 849.
of commercial greenhouses, 758.
requirements, uniformity for nursery stock, 352.
with calcium cyanid, 849.
Fungi—
causing diseases of economic plants, 839.
Manitoba, preliminary list, 645.
of fruit rots, pycnidial forms, 349.
parasitic, in Wisconsin, 242.
parasitic, temperature relations of growth, 540.
physiology of, studies, 26, 125.
spores in the upper air, 747.
wood-destroying, toxicity of zinc chlorid to, 447.
wood-staining, notes, 250.
Fungicides—
addition of adhesives to, value, Wis., 644, 645.
analyses, Conn. State, 233; Me., 233; N.J., 233.
and insecticides, compatible combinations, U.S.D.A., 448.
lime-sulphur, 145.
treatise, 51.
(*See also* Sprays *and specific forms.*)
Fungus diseases of economic plants, control, 540.
Fur farming industry in Wisconsin, Wis., 675.
Furfural, manufacture from corncobs, optimum conditions, 507.
Furnaces, warm-air—
humidity conditions with, 185.
studies, 288.
Fusafine for bean seed treatment, 841.
Fusafine treatment of barley, tests, 840.
Fusarium—
conglutinans, notes, 542.
lini, physiology of, studies, 146.
lycopersici, notes, 647.
Moniliforme in seed corn, 243.
moniliforme, notes, 542.
oxysporum infection of potatoes, factors affecting, Nebr., 147.
oxysporum, notes, 46, 839.
solani, notes, 844.
sp., notes, 45, 540, 548.
sp., spore germination, effect of acidity, 125.
spp., growth inhibiting factors, Iowa, 722.
spp., identification, 646.
spp., notes, 149; Miss., 441, 442.
Fusicladium dendriticum. (*See* Apple scab.)
Fusoma parasiticum, notes, 147.

Galleria mellonella, epidemic among, 155.
Galls, vegetable, character and origin, 45.
Game, conservation laws of Maryland, 250.
Game in savage Sudan, 847.
Games for organized play, manual, 297.
Ganoderma applanatum, notes, 540.
Ganoderma applanatura, notes, 45.
Garbage, feeding value, Wyo., 470.
Garden crops, insects affecting, N.Mex., 553.
(*See also* Vegetables *and specific crops.*)
Gardening for twentieth century, 836.
Gardening, treatise, 836.
Gardens—
construction, treatise, 439.
historic, of Virginia, 836.
variety in, treatise, 836.
Garget, catarrhal, cause and treatment, West.Wash., 884.
Gas engines. (*See* Engines, internal combustion.)
Gas sales, relation to home cooking, 57.
Gas water, fertilizing value, 216.
Gaseous detonation, laws governing, 387.
Gasoline—
and kerosene carburetion, experimental survey, 85.
automobile, treatise, 85.
consumption on different road surfaces, 687.
volatility, changes in, effect on fuel consumption, 887.
Gastric secretion—
and alkáline tide, 560.
in health and disease, 363.
Gastritis, parasitic—
in cattle, treatment, 786.
in lambs, 283.
Gastrophilus equi. (*See* Bots.)
Geese, North American, life histories, 756.
Geese, raising for feathers and skins, 374.
Geese, raising in Argentina, 171.
Gelatin—
chemistry and technology, 206.
for ice cream, determining quality, 377.
in ice cream, determination, 13.
jelly strength test for judging, 879.
quality, effect on viscosity and melting resistance of ice cream, 177.
Gelechia gossypiella. (*See* Cotton bollworm, pink.)
Genes, Mendelian, function, 266.
Genetic—
differences, analysis, 567.
experiments with guinea pigs and rats, 864.
formula for calculating number of individuals to obtain a given frequency, 462.
Genetics—
and adaption, 567.
Department of Carnegie Institution, work, 24.
(*See also* Heredity *and* Hybridization.)
Geology and water resources of Sacramento Valley, 587.
Geology, comprehensive, treatise, 510.
Geometrid, corn-feeding, notes, 154.
Georgia College, notes, 98.
Georgia Station, report, 598.
Geotropism, theory, 219.
Geranium bacterial leaf spot, 250.
German Society of Food Chemists, 608.
Germination, biology of, 232.
Giardia intestinalis, notes, 477.
Gibberella saubinetii—
description, 445.
Fusarium affecting, 840.
in seed corn, 243.
notes, Ind., 538; Ky., 541.
Gibellinia cerealis, notes, 45.
Ginger disease, new, 147.
Gipsy moth—
control, U.S.D.A., 852.
in New Jersey, present status, 355.
quarantine, Conn.State, 655.
tree-banding material, barrier factors in, U.S.D.A., 253.
Girls, basal metabolism of, 457.
Girls' clubs—
of Northern and Western States, status and results, U.S.D.A., 394.
organization, Alaska, 491.
organization in Iowa, 96.
projects, 297.
Gizzard, function of, 71.
Glanders, control, 179.
Glanders, notes, 278.
Gliadin, effect on growth, 360.
Globulin, crystaline, of cantaloup seed, 714.
Gloeosporium—
lindemuthianum, notes, 841.
sp., notes, 548.
Gloeosporium on walnut, 847.
Glucose, determination, effect of soluble calcium salts, 112.
Glucose in muscles of animals on different diets, 570.
Glue, chemistry and technology, 206.
Glumes of grasses in the upper air, 747.
Glutelin, composition, 714.
Glycogen in muscles of animals on different diets, 570.
Glyptotermes pubescens n.sp., notes, 550.
Goat manure, use, N.Mex., 517.
Goats, care in health and disease, 377.
Goats, horn-transmission, Idaho, 268.
Goat's milk, vitamin C in, Ohio, 259.
Goats, stomach worms of, control, Tex., 481.
Goiter—
in calves and sheep, iodin for, Wis., 681.
in goats, control, Mont., 178.
prevention, 769.
Gomphocerus sibiricus, control in Russia, 450.
Gooseberries—
culture, Mont., 136.
culture experiments, Alaska, 435.
insects affecting, Oreg., 555.
pot-grown, fertilizer experiments, 833.
time of fruit bud differentiation, 834.
varieties, classification, 834.

Gooseberry—
and black currant hybrids, 436.
anthracnose, control, Oreg., 547.
die-back, control, Oreg., 547.
powdery mildew, control, Oreg., 547.
silver-leaf, notes, 845.
Gossyparia spuria, distribution, 758.
Grafting in India, manual, 741.
Grain—
and Hay Show, 1922, International, Mich., 97.
aphis, spring, control, Okla., 450.
crops, effect of phosphatic fertilizers, 726.
ear deformation in, cause, 246.
effect of fallow, Nebr., 527.
elevators, cost of operation, Kans., 489.
elevators, farmers', in Iowa, Iowa, 293.
elevators, types, 293.
farm organization, Wash.Col., 291.
formaldehyde treated, effect on fowl, 377.
grinders, tests, 486.
handling in France in eighteenth century, regulation, 91.
handling, treatise, 293.
hulls, composition and digestibility as affected by sodium hydrate, 167.
Inspection Laboratory, Montana, work, Mont., 231.
moth, parasite of, 256.
purchasing power, Nebr., 292.
rotation experiments, Oreg., 526.
seed, impurities, 736.
smuts, control, 645.
(*See also* Smut *and specific grains.*)
storage, 153.
stored, treatment with chloropicrin, 455.
variety tests, cooperative overstate, Mich., 97.
with pasture, value for cows, Oreg., 578.
(*See also* Cereals *and* Oats, Rye, Wheat, *etc.*)
Grains—
small, effect on following crop, Nebr., 732.
spring, comparison, Pa., 223.
staining methods, N.Y.State, 731.
Granary weevil, control, Mont., 251.
Granary weevil, parasite of, 256.
Grape—
berry moth, control, Mich., 53.
beverage, preparation, Calif., 412.
black measles, notes, Calif., 248.
cluster disease, studies, 547.
leaf curl, control, 144.
leafhopper—
control, 654.
effect on sugar in grapes, 850.
notes, 848.
mildew, false, control, 144.
phylloxera. (*See* Phylloxera.)
Grape—Continued.
production and rainfall deficiency, correlation, 808.
production in Arizona, Ariz., 641.
production in Michigan, Mich., 495.
root weevil, biology and control, 50.
roots, disinfection, for winter eggs of phylloxera, 655.
water berries, notes, Calif., 248.
Grapefruit—
culture experiments, Tex., 436.
pruning, Calif., 641.
vitamin C in, 563.
Grapes—
breeding experiments, 437.
Concord, fruiting habit, 237.
culture, Mich., 236; Oreg., 535.
culture, and arsenicals, paper on, 50.
grafting experiments, Tex., 435.
Isabella, jellying properties, Hawaii, 411.
Madaleine Angevine, 140.
new or noteworthy, N.Y.State, 338.
spray schedules for, N.J., 138.
sugar content as affected by leafhopper injury, 850.
varieties in Valencia, 237.
varieties, root systems, 41.
Vinifera, training, N.Mex., 532.
(*See also* Vineyards.)
Grapevine—
apoplexy, treatment, 649.
disease, 45.
Grapevines, recovery from spring frosts, 140.
Graphite, use as solid lubricant, 888.
Graphium penicillioides, notes, 250.
Grass—
creeping bent, vegetative planting, 635.
seedings, effect of previous crops, Can., 734.
seeds, iron and manganese content, 202.
Grasses—
absorption of water and nitrates, 29.
agricultural, persistence, Can., 734.
breeding experiments, Fla., 824.
culture experiments, 329; Mont., 430; Tex., 429.
lawn and pasture, studies, Fla., 823.
mixtures for pasture, Pa., 223.
mosaic disease of sugar cane on, 647.
native, value for hay and silage, Alaska, 426.
newly introduced, behavior and adaptation, Fla., 824.
pasture, effect of grazing, U.S.D.A., 866.
seed, germination tests, U.S.D.A., 866.
tests, Oreg., 525.
varieties, Mont., 130.
variety tests, Idaho, 732.
yields, 735.
(*See also* Pastures, *and specific kinds.*)
Grasshopper bait, sodium arsenate for, Colo., 51.

Grasshoppers—
control, Colo., 450; Mont., 251, 450.
control in Russia, 450.
nema parasite of, 357.
occurrence and control, Mont., 152.
poison bait for, Wis., 654.
(*See also* Locusts.)
Grassland communities, structure, 30.
(*See also* Grass *and* Pastures.)
Gravel for roads. (*See* Road materials.)
Grazing—
effect of different systems on gains made by steers, U.S.D.A., 866.
land situation in Saskatchewan, 894.
research, 30.
(*See also* Ranges.)
Green bug. (*See* Grain aphis, spring.)
Green manure—
for chlorotic pear trees, 755.
use, R.I., 510.
value of whole plants and parts, 121.
Green manuring—
effect on dry farming, Nebr., 527.
experiments, 121.
studies, Miss., 420.
Greenhouse—
soil, sterilization, Ind., 540, 636.
thrips out of doors in Georgia, 153.
Greenhouses—
carbon dioxid for, method of supplying, 741.
construction and heating, U.S.D.A., 487.
fumigation, 758.
Greensand marl, use, 624.
Greensand, poisonous, cause of toxicity, 22.
Grillacris sp., notes, 550.
Growth—
in animals, 164.
of rats, effect of vitamin A and ultraviolet light radiation, 60, 61.
promoting accessory. (*See* Vitamin.)
rate, relation to age in willows, 424.
Gryllus assimilis, life history, enemies and control, S.Dak., 549.
Guam Station, report, 494.
Guar, culture experiments, Tex., 429.
Guatemala grass, notes, Guam, 427.
Guava, vitamin C in, 563.
Guavas, jellying properties, Hawaii, 411.
Guignardia baccae, notes, 547.
Guinea grass, notes, Guam, 427.
Guinea pigs—
birth weight, factors affecting, 864.
complement deficient, blood elements in, 880.
effects of inbreeding, 567.
effects of removal of the mammary glands, 864.
epizootic among, 262.
genetic experiments with, 864.
glycogen and glucose in muscles, 570.
sex ratios in, 864.
thyroidectomized, behavior toward scorbutic ration, 766.
two new color factors in, 368.
Gumbotils, colloidal properties, 811.
Gurjun, properties and uses, 43.
Gypsum—
ammonium nitrate, fertilizing value, 623.
on Iowa soils, value, 726; Iowa, 723.
resources of United States, 124.
uses in agriculture, 124.
Habrobracon brevicornis, notes, La., 848.
Habronemoses of horses, 283.
Haemaphysalis leporis-palustris, notes, 256.
Haematobia serrata. (*See* Horn-fly.)
Haemonchus similis, notes, La., 283.
Hair, changes in color as affected by temperature, 165.
Halophytes, germination and growth, effect of salinity of water, 730.
Haltica oleracea, control, 252.
Hams, curing, English methods, 470.
Hams on the farm, 272.
Haploa reversa, summary, Ark., 253.
Haplographium chlorocephalum, description, 445.
Haplothrips statices, notes, 850.
Hardpan, effect on root development, 30.
Hardpan subsoils, effect of lime and organic matter, Okla., 420.
Hardwood forests of Western Australia, 837.
Hares, Swiss Field and Alpine, osteological differences, 66.
Harmolita aequidens, notes, 255.
Harmolita grandis, control, U.S.D.A., 588.
Hawthorn silver-leaf, notes, 845.
Hawthorns, culture in New Zealand, 837.
Hay—
annual crops and mixtures, Can., 734.
bales, weight variation, Oreg., 526.
cost of production, N.Y.Cornell, 691.
crops, tests, 825.
fire line, feeding value, 171.
land, fertilizer experiments, N.H., 328.
methods of handling, Colo., 86.
minimum amount for milch cows, 780.
mowing costs, 86.
position in American agriculture, U.S.D.A., 389.
production, trade, and foreign competition in, 794.
rack design, Mich., 487.
yield as affected by weather, 115.
yield, factors limiting, 21.
(*See also specific kinds.*)
Health—
and daily diet, Ark., 364.
survey of Missouri Tuberculosis Association, 193.
Heat—
coagulation of milk, endothermic chemical reaction, 716.
conductivity of brick wall work, 188.
convection currents, instrument used in investigating, 188.
insulators for cold-storage work, 186.
production of school children, 763.
resistance of *Bacillus botulinus* spores, 162.
resisting capacities of trees, 536.

Heat—Continued.
transference and combustion in domestic boiler, 688.
transmission by radiation and convection, 187.
transmission of commercial wall board, Colo., 87.
use against stored grain pests, summary, 153.
(*See also* Temperature.)
Heating—
of houses, fuel-saving possibilities, 186.
of houses with kerosene oil, 185.
system, hot-water, effect of pressure on circulation, 591.
systems, warm-air, studies, 288.
Heifers—
alfalfa v. clover hay for, Ohio, 375.
composition of secretions from udders during pregnancy, 781.
dairy, methods of developing, Kans., 473.
wintering, Idaho, 779; Ind., 579; Oreg., 579.
(*See also* Cows.)
Heliophila unipuncta. (*See* Army worm.)
Heliothis obsoleta. (*See* Cotton bollworm.)
Heliothis virescens, control, V.I., 353.
Heliothrips haemorrhoidalis. (*See* Greenhouse thrips.)
Helminthosporium—
gramineum, notes, Wis., 643.
sativum, parasitism, Minn., 747.
sp., notes, Kans., 443; Ky., 541.
Helminthosporium—
graminicolous species, 747.
morphology, 244.
on barley, 840.
Helminths, new and little known, from British Guiana, 499.
Hemerophila pariana, rapid spread of, 356.
Hemileia vastatrix, studies, 150.
Hemiptera-Heteroptera, British, biology, 252.
Hemoglobin determination in blood, 113.
Hemolysins, production, effect of vitamin deficiency, 279.
Hemorrhagic septicemia. (*See* Septicemia.).
Hemp—
and flax fibers, distinguishing, 33.
breeding, 132.
breeding in Hungary, 228.
culture experiments, Alaska, 426.
fertilizer experiments, Ky., 525; Wis., 630.
in textile industry, 528.
northern seed-maturing, Mich., 495.
seeds, iron and manganese content, 202.
sunn, and manure, fertilizing value, 734.
variety tests, Tex., 429; Wis., 630.
Hen, Black Leghorn, which turned white, 463.
Hen flea, biological notes, 356.
Hens—
digestive action, 373.
genetics of fecundity in, 567.
laying—
correlation between time of beginning and time of cessation, 776.
cottonseed meal v. animal protein for, Tex., 470.
poultry mustard for, Can., 70.
protein feeds for, Idaho, 273, 777.
(*See also* Egg production.)
male plumage in, cause, Wis., 668.
Herd immunity, problem, 585.
Hereditary mechanism, explanation, 567.
Heredity—
and tumors, 279.
in barley, 130.
in beans, 822.
in bees, 453.
in corn, 225, 632, 826.
in pigs, Pa., 269.
in poultry, R.I., 575.
in poultry, treatise, 674.
in rice, 34.
in squash, 822.
in unicellular organisms, 567.
in wheat, Wash.Col., 223.
in Y-(W) chromosomes, 668.
mechanism of, 165.
Mendelian, mechanism, treatise, 266
of acquired characters, 66, 822.
of color. (*See* Color inheritance.)
of defective seeds in corn, 826.
of duration of life in Drosophila, 667.
of eye color in Drosophila, 368.
of fat content of milk, 877.
of fecundity in poultry, 273.
of fruit shape in *Cucurbita pepo,* 629.
of growth and resistance in a wheat cross, 750.
of immunity to potato wart disease, 753.
of milk and meat production in cattle, Wis., 676.
of milk yield, 877.
of rogue type in peas, 741.
of size in rabbits, 366.
of size in rats, 864.
of wheat stem rust resistance, 840.
origin of mechanism, 24.
papers on, 567.
relation to tuberculosis, 567.
sex linked, application, 165.
summary, 128.
(*See also* Linkage, Mutation, Selection, *and* Variation.)
Hessian fly—
control, 657.
control in Iowa, 853.
notes, Iowa, 757.
resistance of wheat varieties to, Kans., 453.
studies, Ohio, 352.
studies in Ohio, 657.

Heterakis—
gallinae, treatment for, 684.
papillosa, removal from ceca of chickens, 183.
Heterodera radicicola, notes, Fla., 838.
Heterodera schachtii, control, 842.
Hevea brasiliensis. (*See* Rubber.)
Hexamethylentetramin, nitrogen action of, 123.
Hibiscus, ornamental, breeding, 238.
Hides and skins, disinfection, 379.
-- (*See also* Skins.)
Highway research projects in United States, 184.
Highway transport, economics, conference on, 83.
Highways. (*See* Roads.)
Histamin, antineuritic action, 261.
Histological sections, mineralization, technique, 408.
Hog cholera—
bacilli, mutation among, 884.
control, 178, 179.
exposure experiments, Ind., 580.
immunity of young pigs to, 481.
immunization, troubles encountered, 481.
notes, 278.
virus, review of literature, 787.
Hogs. (*See* Pigs.)
Home—
demonstration work, improving, 492.
demonstration work in Wyoming, 297.
economics—
and agriculture, cooperative extension, U.S.D.A., 494.
and international relations, 897.
course for foreign girls in California, 797.
courses for extension workers, 596.
education, international organization for, 897.
education, progress in, 695.
government publications pertaining to, 395.
instruction, use of tests and measurements, 798.
project method in, 194.
relation to high-school program, 96.
research in, 596, 710.
research, standards, 492.
staff, relation to extension specialist, 492.
vocational instruction, practice houses in, 797.
vocational program for colored population, 194.
work, modern equipment for, 97.
(*See also* Vocational education *and* Household.)
making courses in New Zealand, 95.
making on the farm, 190.
Honey—
absorption of hydrocyanic acid by, U.S.D.A., 457.
flow conditions in 1922, Iowa, 757.
protein determination in, 804.
Honeybees. (*See* Bees.)
Honeysuckle, Tartarian, culture, Alaska, 435.
Hookworms, control, 76.
Hookworms in swine, key, 182.
Hop canker, cause, 147.
Hop diseases in England and Wales, 645.
Hop red spider, summary, Oreg., 157.
Hopea odorata timber, properties and uses, 43.
Hopperburn in Vermont, 555.
Hops, fungus diseases, control, 540.
Hormones, cell-division, in plants, 219.
Horn fly, control, 448.
Hornbeam seeds, delayed germination, 141.
Horns, method of preventing, U.S.D.A., 875.
Horns, transmission as sex-linked characters, Idaho, 268.
Horse—
beans, culture experiments, Mont., 430.
bots. (*See* Bots.)
meat, detection by biological reactions, 505.
muscle, creatin content, 613.
semen, H-ion concentration, Ky., 273.
Horseflies in Louisiana, 657.
Horseradish, culture experiments, Alaska, 435.
Horses—
anatomy, dissection guide, 381.
blood of, 683.
breeding, genetics in relation to, Ky., 273.
breeding, history in Palatinate Province, 69.
care in health and disease, 377.
danger of hyperimmunizing against swine erysipelas, 482.
farm work, feeding, 69.
glycogen and glucose in muscles, 570.
growth of hoofs, 683.
parasite in ligamentum nuchae, 178, 284.
polydactylism in, 165.
strongylid larvae in, 256.
thorax and abdomen, topographical anatomy, 787.
Horticulture, experiment station research in, editorial, 101.
Horticulture, teaching, 194.
Hot waves in United States, 808.
Hotbeds and coldframes, construction and use, U.S.D.A., 833.
Hotels, country, improving, 57.
House fly—
fecundity and longevity, 156.
oviposition, observations, 254.
plague in American Expeditionary Force, 853.
Househeating methods, 186.
Household management instruction in Belgium, 798.
(*See also* Home economics.)
Houses, concrete, construction, 87.
Houses, construction to reduce heating costs, 890.
Housework, energy expenditure during, 65.

Hoxie, S., life and contribution to cattle breeding, 374.
Humidity and precipitation, U.S.D.A., 313.
Humidity conditions in residence heated by a warm-air furnace, 185.
Humin formation in protein hydrolysis, 11.
Humus content of St. Joseph Co. soils, Mich., 16.
Humus soils, aqueous solutions, hysteresis, 812.
Humus soils, mechanical analysis, 316.
Hunt, T. F., biographical sketch, 4.
Huntley Reclamation Project Experiment Farm work, U.S.D.A., 898.
Hyacinthus orientalis, heteroploid varieties, 822.
Hybridization—
and behavior, 568.
natural, in rice, 633.
(*See also* Animal breeding, Plant breeding, *and specific animals and plants.*)
Hybrids, partial sterility in, 25.
Hydathodes, nature and reaction of water from, N.Y.Cornell, 520.
Hydrangea sp., propagating in acid medium, 836.
Hydrocyanic acid, absorption and retention by fumigated food products, U.S.D.A., 456.
Hydroelectric power systems of California, 383.
Hydrogen-ion concentration—
colorimetric determination, 803.
determination, 202.
determinations, apparatus and technique, N.Y.Cornell, 712.
effect on—
adsorption of plant food by soil colloids, 17.
bacterial types in intestines, 561.
growth and nitrogen fixation of Azotobacter, 722.
in soils, determination, 309.
measurement in biological media, 110.
of nutrient solutions as affected by wheat seedlings, 627.
of potato dextrose agar, 821.
of soil, significance to plants, 618.
of wheat plant juice, 245.
peroxid, decomposition, 418.
Hydrophobia. (*See* Rabies.)
Hylemyia trichodactyla, notes, 848.
Hylobius abietis, notes, 50.
Hymenoptera—
female reproductive organs in, 50.
parasitic, bionomics, 50.
Hypera punctata in Iowa, 761.
Hypera punctata, oviposition, 848.
Hyperteles lividus, notes, Calif., 53.
Hyphantria cunae. (*See* Webworm, fall.)
Hypochnus theobromae, notes, 540.
Hypodaerium conoideum, life history, 183.
Ice cream—
and the health officer, 277.
fat content, effect on quantity eaten, U.S.D.A., 580.
Ice cream—Continued.
gelatin in, determination, 13.
gelatin, viscosity, and melting resistance, 177.
making, principles, Nebr., 782.
manufacture, Pa., 277.
manufacture, superheated condensed milk in, 679.
palatability, effect of composition, U.S.D.A., 579.
sandiness in, cause, Ind., 580.
vitamins in, 59.
Ichneumon flies, North American, revision, 855.
Ictero hematuria, studies, Colo., 476.
Idaho Station, report, 298, 798.
Illinois Station, notes, 697.
Illinois Station, report, 395.
Illinois University, notes, 697.
Immunity—
establishment, 782.
in veterinary practice, treatise, 78.
passive, duration of 478.
production, biologics in, Okla., 477.
Immunization—
against sheep pox, 480.
of horses, with swine erysipelas cultures, reactions, 482.
of monkeys against pneumococcus, 880.
of plants, 442.
(*See also* Anthrax, Hog cholera, Tuberculosis, *etc.*)
Implement buildings, construction, 586.
Inbreeding in dairy cattle, Ohio, 375.
Inbreeding, papers on, 568.
Incubation of eggs, N.J., 273.
Incubation, optimum temperature, Ind., 573.
Index cephalicus, 770.
Indiana Station, notes, 899.
Indiana Station, report, 599.
Indians, Pima, community work among, 894.
Indol formation during decomposition of salmon, 802.
Industrial—
raw material, present and potential production in French colonies, 389.
Revolution in England, lectures on, 295.
Infantile paralysis. (*See* Poliomyelitis.)
Infants—
blood phosphate in, seasonal tide, 58.
feeding, vitamins in, 856.
newborn, respiratory exchange in, 15
potato flour for, 457.
(*See also* Children.)
Influenza, bovine, studies, 79, 785.
Influenza, equine. (*See* Pleuropneumonia.)
Inheritance. (*See* Heredity.)
Inoculation of plants, chambers for, 821.
Inostemma leguminicolae, description, 157.
Insect outbreaks in Idaho, Idaho, 756.
Insect pests, organization of international measures for protection, 548.
Insect survey of North Carolina, N.C., 757.

Insecticides—
analyses, Conn.State, 233; Me., 233; N.J., 233.
and fungicides, compatible combinations, U.S.D.A., 448.
contact, studies, U.S.D.A., 550.
lime-sulphur, 145.
recent developments in use, 233.
treatise, 51.
(*See also* Sprays *and specific forms.*)
Insects—
as food for common whitefish, 848.
bloodsucking, as disseminators of anthrax, La., 881.
control in New York State, 152.
damage to timber, 84.
forest. (*See* Forest insects.)
in Ontario, 848.
in Quebec, 848.
in the upper air, 747.
injurious—
in Arizona, 251.
in Pulawy, 252.
in St. Thomas, 540.
in Utah, 848.
in Virgin Islands, V.I., 654.
to crops. (*See special crops.*)
survey work in United States, 352.
inoculating sugar cane with mosaic, mechanics of, 47.
instincts and habits, treatise, 251.
light trap for, 51, 550.
nema parasite of, 357.
of garden and orchard, control, West. Wash., 395.
of Pribilof Islands, U.S.D.A., 652.
on imported nursery stock, 352.
relation to poliomyelitis, 450.
respiration, 251.
scale. (*See* Scale insects.)
subterranean, soil treatment for, Wash. Col., 251.
temperature studies, 659.
Insemination, artificial, Ky., 164.
Insulating materials for cold-storage work, 186.
Insulin, purification and properties, 803.
Insurance, accident, law for agricultural workers in France, 693.
International—
Association of Dairy and Milk Inspectors, report, 276, 698.
Conference of Phytopathology and Economic Entomology, 398.
Congress of—
Eugenics, 567.
Household Economy Instruction, 897.
Cotton Congress, report, 331.
Cotton Federation, courts of arbitration, 331.
Federation and Office for Development of Home Economics Education, 897.
Institute of Agriculture at Rome, 492.
Institute of Agriculture, relation to agricultural education and research, 596.
International—Continued.
labor organization and agriculture, 693.
Intestinal—
bacteria, factors controlling, 561.
flora in mouse typhoid, 79.
roundworms in poultry, West.Wash., 395.
Inulin identification, 112.
Iodamoeba williamsi, notes, 477.
Iodin for prevention of goiter, 769; Wis., 681.
Iodin requirements of livestock, Wis., 167.
Iowa College, notes, 98, 196, 697.
Iowa Station, notes, 98, 196, 496, 697.
Iowa Station, report, 798.
Iridomyrmex—
humilis. (*See* Ants, Argentine.)
melleus, notes, 550.
Iron—
arsenate, effect on foliage, 750.
assimilation, rôle of vitamins in, 564.
content of lettuce, 503.
content of seeds, 202.
detection in animal tissues, 408.
determination in blood, 113.
effect on corn, 519.
effect on growth of Aspergillus, 27.
metabolism and vitamins, 564.
oxidation, effect of chemical agents, 617.
salts, effect on bacteriological analysis of water, 285.
salts, effect on corn plant, 327.
sulphate for weed eradication, 738.
Irrigation—
activities and expenditures in India, 586.
canals, concrete lining, advantage, 685.
canals, water measurement devices, description, 886.
districts, operation in Colorado, 383.
effects on alkali salts and plant-food constituents, N.Mex., 886.
experiments, Oreg., 510.
(*See also special crops.*)
in New South Wales, 284.
of rice seed beds, 633.
on the Niger, 82.
project on Piave River, Italy, 588.
pumping for, 886.
studies, Wash.Col., 209, 284.
water and rice soils, studies, Calif., 34.
water, duty of, experiments, Oreg., 526.
water, duty of, Mont., 184.
weir, construction, 789.
Isoanaphylaxis in cattle producing serum against rinderpest, 884.
Isoelectric points, calculation formulas, 501.
Japanese beetle—
feeding habits affecting control, U.S.D.A., 454.
flies parasitic upon, 453.
larvae in golf greens, control, 657.
spread, 854.
summary, 454.

Japanese cane. (*See* Sugar cane.)
Jellies, formation, rôle of acids in, Del., 9.
Jelly making principles, application to Hawaiian fruits, Hawaii, 411.
Jenkins, E. H., biographical sketch, 3.
Jimson weed, variations in, 567.
Johnson grass—
eradication experiments, N.Mex., 525.
seeds, dormancy, after ripening, and germination, 28.
Journal of Agricultural Research, 710.
Jujube fruits, trypetid affecting, 849.
Jute in textile industry, 528.
"Kadondong" beetle, notes, 255.
Kafir—
culture experiments, Okla., 414.
effect on following wheat crop, 332.
feeding value, Okla, 467.
inbreeding and headtype studies, Tex., 429.
variety tests, Kans., 427.
Kainit, fertilizing value, 623, 825.
Kale, culture, West.Wash., 395.
Kale, culture experiments, Alaska, 435.
Kangkong leaves, vitamin C in, 563.
Kansas College, notes, 98, 299, 397, 697.
Kansas Station, notes, 98, 397, 697.
Kansas Station, report, 495.
Kanyin, properties and uses, 43.
Kaolin, analysis, 414.
Kaolin, decomposition, 212.
Kapok industry in Philippines, 132.
Karoo, famine fodder for, 265.
Kentucky Station, notes, 98, 397.
Kentucky Station, report, 599.
Kentucky University, notes, 397.
Kerosene and gasoline carburetion, experimental survey, 85.
Kerosene oil, burning in house-heating boilers, 185.
Ketones, hydrolysis in presence of, 11.
Kidney worm of swine, description, 787.
Kikuyu grass as smother crop for bracken fern, 33.
Kiln drying handbook, U.S.D.A., 386.
Kisso, feeding value, 72.
Kumquat, culture experiments, Tex., 436.
Labor income, factors affecting, Miss., 488.
Labor incomes from poultry farms, 593.
(*See also* Agricultural labor.)
Laboratory work, aims and value, 596.
Lac cultivation in India, 851.
Lachnopus coffeae—
montanus n.subsp., notes, 550.
n.sp., notes, 550.
Lachnosterna spp., control, 549.
Lachnosterna spp., studies, Miss., 454.
Lactalbumin, soluble, from whey, 312.
Lactalbumin, tryptophan determination, 714.
Lactation curve, shape of, 876.
Lactose extraction from whey, 312.
Lamb, cold-storage holdings, U.S.D.A., 893.
Lamb, use in diet, U.S.D.A., 660.
Lambs—
docking and castrating, Pa., 269.
fattening, Iowa, 870.
Lambs—Continued.
feeding and care, 297.
feeding experiments, 774, 870; Iowa, 571; Nebr., 670, 773, 774.
killing, dressing, and cutting, 67.
(*See also* Sheep.)
Lamium amplexicaule, cause of staggers, 178.
Land—
clearing studies, Wis., 687.
continuously cropped to hay, rejuvenation, N.H., 328.
credit. (*See* Agricultural credit.)
grant colleges. (*See* Agricultural colleges.)
grant institutions, tendencies and problems, 596.
holdings, expropriation in Italy, bill for, 891.
holdings, rural small, facilities for acquisition in France, 891.
methods of allotment in Burma, 389.
nationalization, treatise, 389.
plaster. (*See* Gypsum.)
reform in Czechoslovakia, 891.
tenancy types, relation to types of farming, Iowa, 793.
tenure, studies, Nebr., 189.
valuation, manual of rural appraisement, 90.
values and fertilizers, 792.
Lands—
arid, reclamation in Wyoming, 483.
bad, biotic succession in, 30.
cut-over. (*See* Cut-over land.)
forest. (*See* Forests.)
swamp. (*See* Swamps.)
uncultivated, economic utilization, 709.
Laphygma frugiperda. (*See* Army worm, fall.)
Larch—
as nurse crop, 743.
European, culture in New Zealand, 837.
Japanese, new disease, 445.
Japanese, Phomopsis disease of, 446.
sawfly, large, studies, 454.
Lard, cold storage holdings, U.S.D.A., 893.
Lard, vitamin A in, effect of hog feed, 59.
Larkspur, poisonous to cattle, Nev., 583.
Lasioderma serricorne. (*See* Cigarette beetle.)
Lasiodiplodia theobromae, notes, 540.
Laspeyresia molesta. (*See* Peach moth, oriental.)
Laterite soils of Goa, 16.
Laundries, cooperative, in United States, 391.
Laurel silver-leaf, notes, 845.
Lavender diseases in England and Wales, 645.
Law of diminishing returns, application, 89.
Lead—
arsenate for fruit tree leaf roller, tests, Mont., 852.

Lead—Continued.
arsenate, insecticidal value, 759.
arsenate, properties, U.S.D.A., 448.
arsenates, action of soap upon, 553.
arsenates, effect on foliage, 750.
compounds, stimulating effect, 23.
determination in biological material, 113, 114.
oxid, insecticidal value, U.S.D.A., 449.
salts, effect on bacteriological analysis of water, 285.
white, use as solid lubricant, 888.
Leaf roller, control, Wash.Col., 251.
Leaf scorch, notes, 48.
Leafhoppers, control, 654.
Leafhoppers, notes, Oreg., 555.
Leather—
belting specifications, 590.
belting, tests of flesh and grain sides, 486.
home tanning, U.S.D.A., 717.
wearing qualities, U.S.D.A., 717.
Leaves in sun and shade, carbohydrate production, 728.
Legume cover crops for coconuts, Guam, 427.
Legumes—
as affected by potash, 817.
as green manure, Calif., 19.
as silage crop, 166.
culture experiments, Tex., 429.
effect on organic matter in soil, N.Y. Cornell, 117.
inoculants for, tests, N.J., 636.
inoculation, Mich., 97.
inoculation, commercial cultures for, Iowa, 723.
inoculation, efficiency for Arizona soils, Ariz., 620.
(*See also* Nodule bacteria.)
manganese and iron determinations, Ky., 520.
manganese requirement, 731.
mealybugs attacking nodules, 655.
nitrogen-fixing capacity, factors affecting, Wis., 620.
production in Spain, 193.
relation to soil fertility, Ala., 725.
tests, Oreg., 525.
variety tests, 31, 252; Idaho, 732.
(*See also* Green manure *and* Alfalfa, Clover, *etc.*)
Lemon—
black pit, notes, Calif., 651.
groves of Spain, diseases and pests, 438.
gummosis, notes, 650.
juice, antiscorbutic factor as affected by cod liver oil, 58.
juice, decitrated, preservation, 806.
juice, effect of reaction on oxidation of vitamin C, 806.
juice, sterilized, antiscorbutic value, 365.
shellbark disease, studies, 847.
weevil, Fiji, notes, 56.
Lemons, production east of Mount Etna, 835.
Lemons, pruning, Calif., 641.
Lentils, nickel and cobalt in, 520.
Lenzites sepiaria—
as affected by zinc chlorid, 447.
control, Oreg., 539.
spore germination, effect of acidity, 125.
Lepidium draba, eradication, 832.
Lepidoptera on tobacco in Porto Rico, 52.
Leptinotarsa decemlineata. (*See* Potato beetle, Colorado.)
Leptobyrsa rhododendri, control, 153.
Leptoglossus gonogara, control, V.I., 353.
Leptosphaerella platensis n.sp., description, 445.
Lespedeza. (*See* Clover, Japan.)
Letis mycerina, notes, 550.
Lettuce—
culture experiments, Alaska, 435.
disease, new and undescribed, Tex., 442.
downy mildew in California, 346.
drop, control, 246.
greenhouse, fertilizer experiments, R.I., 533.
head, growing, harvesting, and marketing, Colo., 137.
iron content, 503.
nickel and cobalt in, 520.
notes, R.I., 533.
production, Wyo., 337.
root rot and tipburn, Ky., 543.
variety tests, Guam, 435.
Leucaena glauca, feeding value, Guam, 464.
Leucite, use as potassic fertilizer, 817.
Leucocytes, effect of vitamin deficiency, 280.
Leucosis of fowls, 81.
Leukemia problems, 81.
Levulose solution, effect on bud growth of cuttings, 834.
Life, duration in Drosophila, 568.
Life, duration in Drosophila, inheritance, 667.
Light—
artificial, effect on egg production, Can., 71; Ind., 573; Ky., 574; Mont., 171; Okla., 470.
colored, effect on *Azotobacter agile,* 18.
effect on estimating uric acid in blood, 113.
period, daily, effect on plant development, 326.
prevention of rickets by, Wis., 664.
trap for insects, 51.
waves in relation to protective action in rickets, 65, 365.
(*See also* Sunlight *and* Sunshine.)
Lignoceric acids, method of determination, 611.
Lilies, sterility in, 141.
Lime—
analyses, N.J., 325.
arsenate. (*See* Calcium arsenate.)
as an amendment, 324.

Lime—Continued.
by-product, analyses and value, 22.
copper dust v. sprays, N.Y.State, 49.
different forms, action, 818.
effect on—
action of calcium arsenite, 751.
biological activities in acid soils, Oreg., 514.
green manuring, Miss., 421.
hardpan subsoil, Okla., 420.
organic matter in soil, N.Y.Cornell, 117.
sour soils, R.I., 512.
faulty, in Bordeaux mixture, 145.
fertilizing value, 815.
for sprays, storage experiments, 145.
function in soil, 516.
inspection and analyses, 215.
inspection and analyses in Ohio, 124.
nicotin dust, cooperative experiments, 152.
niter. (*See* Calcium nitrate.)
nitrogen. (*See* Calcium cyanamid.)
phosphoric acid system, compounds in, 214.
precipitated, paper on, Ohio, 298.
requirement of live stock, Wis., 167.
requirement of soils. (*See* Soils.)
resources of United States, 124.
sulphur—
and Bordeaux mixture, comparison, Iowa, 746.
dry-mix, as substitute for self-boiled lime-sulphur, N.J., 349.
effect on arsenical compounds, 751.
fungicides and insecticides, 145.
use against San José scale, 452.
v. Bordeaux mixture, 44.
toxicity to *Fomes lignosus*, 518.
(*See also* Calcium *and* Liming.)
Limequats, new citrus hybrid, 41.
Limes, culture and pests, Hawaii, 641.
Limestone—
analyses, Me., 218.
effect on alfalfa, Mich., 431.
inspection and analyses in Ohio, 124.
methods of applying, Ohio, 323.
tests, Mo., 24.
Liming experiments, 516, 624; Guam, 414; Ohio, 724.
(*See also* Lime *and special crops.*)
Liming, importance in soil management, 818.
Linkage in corn, N.Y.Cornell, 32.
Linkage with lethal factors in Oenothera problem, 567.
Linseed meal as protein supplement for pigs, Mich., 469.
Lipochromes, association of vitamin A with, 768.
Liponyssus bursa, notes, 381, 848.
Liquids, biological, determination of H-ion concentration, N.Y.Cornell, 712.
Liquids, carbon content, determination, 803.
Lithium in Hagerstown soil, 617; Pa., 210.
Livestock—
best breeds in Italy, 67.
diseases. (*See* Animal diseases.)
equipment for Wyoming, 890.
in Netherlands, 94.
in Southeastern Ohio, Ohio, 298.
increase in value, division between landlord and tenant, 892.
industry in Algeria, 895.
industry, world's and British needs, U.S.D.A., 892.
injury from wire grass, 679.
management in connection with teaching of rural science in elementary schools, 394.
mineral requirements, Wis., 167.
plants poisonous to, and first aid, 177.
(*See also* Plants, poisonous *and specific plants.*)
present and potential production in French colonies, 389.
prices, fall, in Czechoslovakia, 92.
purebred, associations in Canada, records, 267.
raising in French Alps, 390.
shipping associations—
cooperative, Mo., 293.
organization and management, Minn., 488.
slaughtering, 570.
statistics, U.S.D.A., 391.
statistics of Arizona, 392.
statistics of Brazil, 392.
statistics of Canada, 491.
statistics of Connecticut, 392.
(*See also* Agricultural statistics.)
(*See also* Animals, Cattle, Sheep, *etc.*)
Liver—
fluke infection, complement fixation reaction in, 77.
oils, sulphuric acid test for, 410, 611.
vitamin A storage in, 200.
Lizards, food habits, 151.
Lizoniella platensis n.sp., description, 445.
Loco eradication, Mont., 178.
Locusts, control, 450.
(*See also* Grasshoppers.)
Loganberry—
bud blight, notes, Oreg., 546.
crown gall, 45.
die-back, control, Oreg., 539.
mosaic, notes, Oreg., 755.
plantations, establishment and care, Oreg., 742.
Louisiana Stations, notes, 99, 397.
Louisiana Stations, report, 898.
Loxostege sticticalis, life history and habits, 253.
Lubricants—
measurement of oiliness, friction testing, 387.
solid, summary of information, 888.
Lubricating oils, motor, tests, 384.
Lucern. (*See* Alfalfa.)
Lucilia sericata, notes, 156.

Lumber—
cut of United States, U.S.D.A., 239.
kiln drying, U.S.D.A., 386.
rôle in economic progress and international trade, 94.
(*See also* Timber *and* Wood.)
Lumpy jaw. (*See* Actinomycosis.)
Lunar periodicity in living organisms, 115.
Lungworms in hogs, life history and habits, 80.
Lupinus argenteus, chemical examination, Wyo., 476.
Lupinus spp., *Thielavia basicola* on, 843.
Lycophotia margaritosa, meteorological relations, Minn., 759.
Lyda stellata, parasitism by tachinids, 255.
Lydella hyphantriae n.sp., studies, 555.
Lymphadenitis, caseous, diplococcus associated with, 786.
Lymphangitis, ulcerative, in sheep, 80.
Lysiphlebus testaceipes, larval stages, 559.
Macaroni wheat. (*See* Wheat, durum.)
Machinery. (*See* Agricultural machinery.)
Macrodactylus subspinosus. (*See* Rose chafer.)
Macromischa isabellae, notes, 550.
Macrophoma reinformis, notes, 547.
Macrosiphum solanifolii, notes, Idaho, 746.
Macrosporium attacking onion, 839.
Macrosporium—
solani, notes, 46.
sp., notes, Ga., 346; Ky., 541.
spp., notes, 149.
Magnesia, fertilizing value, 815.
Magnesia, injury to cereals, 628.
Magnesium—
content of rain water, 413.
nitrate, use for determining sulphur in soil, 22.
oxid dust, effect on soil, Wash.Col., 209.
oxid, insecticidal value, U.S.D.A., 449.
Mahua cake, nitrification, 117.
Maize. (*See* Corn.)
Malaria. (*See* Mosquitoes *and* Anopheles.)
Malic acid determination in fruit juices, 805.
Mallow rust, studies, 651.
Malt extract, value, 663.
Malt flour, diastatic activity, studies, 13.
Malt-sprout poisoning, 279.
Malta fever and abortion, relationship, 380.
Maltose, detection and identification, 112.
Malva parviflora, cause of staggers, 178.
Mammals—
development, disturbances produced by radium, 567.
of District of Columbia, 448.
of Pribilof Islands, U.S.D.A., 652.
of Utah, 756.
(*See also* Animals *and specific kinds.*)
Man in agriculture, treatise, 191.
Mandarin disease, notes, 150.
Manganese—
agrologic study, 215.
compounds, stimulating effect, 23.
content of seeds, 202.
distribution in plants, 221; Ky., 520.
Manganese—Continued.
sulphate, increased concentrations, effect on plant growth, 730.
Mange and allied mites, handbook, 76.
Mange, parasitic, control, 179.
Mange, parasitic, notes, 278.
(*See also* Sheep scab.)
Mangels—
as chinch bug control crop, Ill., 431.
effect on following crop, 231.
fertilizer experiments, Can., 734.
food value and vitamin A deficiency, 262.
production, West.Wash., 395.
variety tests, 825; Alaska, 426; Can., 734.
Manger for experimental cattle feeding, description, 778.
Mangoes, red-banded thrips affecting, 555.
Mangoes, smudging, effects, 835.
Manioc. (*See* Cassava.)
Mannite decomposition, capacity of soil for, 118.
Mannite determination in soil extracts, 804.
Mannose from white spruce cellulose, 206.
Manure—
Bacillus botulinus in, 860.
best use in a rotation, Ohio, 323.
effect on—
carbon dioxid production, 421.
hardpan subsoil, Okla., 420.
fertilizing value, Kans., 427; Tex., 436.
liquid, nitrogen losses from, 118.
liquid, pumps, tests, 486.
nitrogen losses from, 118.
use, R.I., 510.
use in reclamation of alkali soils, U.S.D.A., 622.
utilization, Wis., 623.
(*See also* Cow manure, Goat manure, *etc.*)
Manuring experiments, Ohio, 724.
Maple—
case-bearer, studies, N.Y.Cornell, 355.
sirup and sugar, cost of production, 692.
sirup production, Mich., 43.
Mares, immunization against abortion, Ky., 581.
Mares, sterility in, Ky., 272.
Margarin, analysis, 505.
Margarodinae, notes, 851.
Margaropus annulatus. (*See* Cattle tick.)
Marine animals, zinc and copper in, 258.
Market, Center, in Washington, D. C., operation, 190.
Market gardens. (*See* Truck crops.)
Market reports, U.S.D.A., 90, 294, 390, 594, 693, 793, 892.
Marketing—
cooperative, 190.
education, 797.
in North Carolina, N.C., 294, 489, 793.
problem, 892.

Marketing—Continued.
problems, rôle of commission shops in, 294.
system for agricultural products, 892.
Markets, jobbing, of Philadelphia, U.S.D.A., 90.
Marl, fertilizing value, 818.
Marls, analyses, 512.
Marunguey, notes, 586.
Maryland Station, notes, 196.
Maryland Station, report, 599.
Massachusetts Station, bulletin summary, 495.
Mastitis, bovine, principles, 178.
Mastitis, infectious, of cattle, Oreg., 582.
Matsap pan as source of nitrate, 123.
May beetles, studies, Miss., 454.
Mayetiola destructor. (*See* Hessian fly.)
Meadow fescue. (*See* Fescues.)
Meadow foxtail, culture experiments, 735.
Mealybug, Baker's, on cedar in Florida, 354.
Mealybug, control, 448.
Mealybugs on roots and nodules of legumes, 655.
Mealybugs, summary of information, 452.
Measures used in agriculture in Brazil, conversion into metric system, 392.
Meat—
analysis from different cuts, N.Mex., 869.
feeding of pigeons, studies, 359.
frozen, autolysis, 11.
frozen, trade in Australia and New Zealand, 168.
horse. (*See* Horse meat.)
inspection, regulations governing, U.S.D.A., 782.
killing, cutting, and curing, 570.
packers' encyclopedia, 370.
packing and cold storage interests in Great Britain, U.S.D.A., 892.
preservation by freezing, 559.
production, relation to needs of Great Britain, U.S.D.A., 892.
scrap, feeding value, 273.
(*See also* Beef, Pork, *etc.*)
Mechanical testing, treatise, 887.
Mechanics, analytical, treatise, 284.
Mechanics, farm, treatise, 284.
Media. (*See* Culture media.)
Medicinal plants. (*See* Drug plants.)
Medlar fruits, discomycete on, 250.
Megasse, fertilizing value, 122.
Meibomia (Desmodium), agricultural value, 34.
Melanin, chemical nature, 575.
Melanose, studies, Fla., 838.
Meligethes aeneus, control, 252.
Melilotus. (*See* Sweet clover.)
Meliola sp., notes, 45.
Melon aphid, control, Wis., 653.
Melon mosaic, notes, Iowa, 746.
Mendelian ratio, effect of selection, 769.
Mercuform for bean seed treatment, 841.
Meridarchis scyrodes, notes, 849.
Meromyza americana, studies, S.Dak., 549.
Mesquite bean, famine fodder for Karoo, 265.
Metabolism—
bacterial studies, 609, 610.
basal, of girls, 457.
basal, of school children, 763.
basal, standards, 57.
basal, summary of data, 57.
calcium, effect of vitamins, 58.
cellular, of polyneuritic pigeons, 766.
crate for calves and small ruminants, 164.
in China, 660.
on vitamin-free diet, 459.
Metallic salts, effect on—
bacteriological analysis of water, 285.
nitrogen fixation, 18.
Metarrhizium anisopliae, notes, Nebr., 659.
Metastrongylus spp., notes, 80.
Meteorological—
conditions, importance in potato diseases, 752.
notes, U.S.D.A., 827.
observations, Alaska, 413; Can., 809; Guam, 413; Ky., 509; Mass., 208, 509, 719; U.S.D.A., 207, 412, 413, 508, 615, 718, 809; Wyo., 413.
observations in Assam, 15.
observations in Tunis, 16.
records at Bozeman, Mont., 116.
Meteorology—
agricultural, field for investigation, 807.
papers on, 614; U.S.D.A., 207, 508, 509, 718.
(*See also* Climate, Rainfall; Temperature, Weather, *etc.*)
Meteorus, revision of genus and new species, 855.
Methylene blue, use in determination of reducting sugars, 310.
Mica, use as potassic fertilizer, 817.
Mica, use as solid lubricant, 888.
Michigan—
College, notes, 99, 196, 397, 799, 899.
Station, notes, 99, 196, 899.
Station Quarterly Bulletin 97, 495, 898.
Microbracon meromyza, notes, S.Dak., 549.
Micrococcus—
catarrhalis, notes, 682.
melitensis and *Bacillus abortus,* relationship, 881.
(*See also Bacterium melitensis.*)
pyogenes albus, notes, Ky., 581.
Microorganisms—
affecting cotton fibers, 646.
autotrophic, oxidizing selenium, 23.
oxidation of zinc sulphid by, 18.
(*See also* Bacteria and Organisms.)
Microsphaera alni, notes, 446.
Middlings, standards for, 65.
(*See also* Wheat; Rye, *etc.*)
Mildew, downy, on seed corn, treatment, 750.
Mildew, epidemic of, 1921, 445.
(*See also host plants.*)
Milk—
abnormal, detecting, 677.
agglutinins in, source, 280.

Milk—Continued.
and fat production of breeds, 174.
and milk products, methods and costs of selling, 677.
acidity, effect on alcohol test, 717.
analyses, physico-chemical, 716.
as affected by—
cod liver oil feeding, 780.
fish meal feeding, Fla., 874.
as carrier of disease, 176.
bacterial—
analysis, methods, 275.
content, reductase test for, 612.
counts, 277.
counts in, irregularities, 700.
counts, Skar method, 376.
bitter, cause, 74.
cans, effect of steam on germs, 277.
certified, producing, paper on, 176.
characters, variation and inheritance, 474.
chocolate, examination and evaluation, 204.
clarification for cheese making, N.Y. Cornell, 475.
clean, aids in production of, 175.
coagulation—
by acid, 804.
during sterilization, 73.
in alcohol test, factors affecting, 716.
condensed and dried, methods of production, 679.
conditions in Iowa, 277.
content of milk chocolate, 204.
contests, city, 277.
control, organization and administration, 277.
cooling, methods, 175, 698.
cost of production, Wash.Col., 291.
cost of production—
effects of the war, 793.
in Wisconsin, U.S.D.A., 88.
cryoscopic examination, 275.
detection in breadstuffs, 611.
determination of H-ion concentration, N.Y.Cornell, 712.
determination of phosphoric acid in, 805.
dried, for infant feeding, 700.
effect of unsterile utensils on, 475.
ewes', analyses, 175.
fat, Babcock test for, Ky., 276.
fat, casein as protective agent, 805.
fat content, inheritance, 877.
fat determination in butter, 113.
fat, fatty acid content, 678.
fat percentage, effect of temperature, 73.
fat percentage, seasonal variations, 73.
fat percentages and production of Friesian cows, correlation coefficient, 677.
fat percentages and yields of different tests, relation, Me., 174.
fat production, feed cost of, Ill., 576.
fat production, seasonal variations in, 677.
Milk—Continued.
fat, quality as affected by velvet bean meal, Fla., 875.
feed cost of, Ill., 576.
flow in the cow, 173.
food value, 277, 364, 699; Okla., 459.
for health campaigns, education, U.S.D.A., 494.
fresh, specific gravity, 275.
from different breeds, cream rising power, 781.
from Norrbotten, composition, 73.
from Polish Red cows and Whitebacks, comparison, 175.
goat's, nonprotein nitrogen in, 175.
handling, improvement, 475.
heat coagulation theory, 716.
high quality, rejected by laboratory tests, Wis., 677.
houses, diagrams, 175.
human, excretion of foreign protein in, 361.
human, fat content, 275.
improvement, policies and methods, 276.
inspection, 275.
inspector, relation to milk plant manager, 277.
keeping quality, estimating, N.H., 311.
laws from 1916 to 1919, 377.
laws in Scotland, 377.
marketing, papers on, 277.
nitrogen determination in, 111.
nutritive properties and reproductive failure in rats, 663.
ordinance, proposed for local boards of health, 175.
pasteurization, 276, 699.
pasteurized, cream layer, relation to temperature, 276.
plant machinery, efficiency, 277.
plant, modern, structure and equipment, 276.
plants, operation, U.S.D.A., 377.
powder, bacterial content, 75.
powdered, structure, 75.
production and—
butter fat percentages of Friesian cows, correlation coefficient, 677.
dairy products in New York State, 177.
distribution in New South Wales, 475.
trade, 376.
production as affected by—
drugs, Iowa, 779.
silage feeding, Pa., 472.
Sudan grass pasture, Kans., 472.
production—
corn v. sunflower silage for, Idaho, 778.
economics, relation to composition of rations, N.Y. Cornell, 577.
effect of age and stage of lactation, 173.
factors affecting, 875.
of individual cows, 174.

Milk—Continued.
production—continued.
pasture crops for, Idaho, 778.
ration for, Fla., 875.
seasonal variations in, 677.
significance of balance in, 875.
tests of roughages for, Iowa, 578.
winter and summer, economics of, 173.
winter, rations for, 874.
products, solids in, comparison of cost, 376.
remade, 699.
remade, distinguishing, 277.
sale in Scotland, testimony regarding regulations, 475.
secretion—
physiology of, 173.
rate of decline in lactation period, 375.
studies, 677; Me., 174.
serum protein, 802.
serving in schools, 277, 700.
sickness, notes, Ind., 580.
skimmed. (*See* Skim milk.)
sodium chlorid in, 311.
solids-not-fat in, determining, 677.
substitutes for calves, U.S.D.A., 875.
supplies, inspection, U.S.D.A., 878.
supply, city, standards, 277.
supply of London, papers on, 277.
supply, relation to bovine diseases, 277.
surplus, utilization, 277.
temperatures and bacterial content, 698.
transportation, 699.
transportation and handling, 277.
transportation in metal tanks, 276.
treatise, 175.
urea content, 205.
value and care, educating public concerning, 699.
vitamin A content, increasing, 780.
vitamin B in, as affected by ration of cow, Wis., 666.
vitamin content and food value, 176.
vitamin content, effect of formaldehyde, 459.
watered, detection, 612, 805.
whole, skimmed, and filled, vitamin A in, Wis., 664.
yield, inheritance, 877.
yield of different lactations, relation, 677.
yields and butter-fat percentages of different tests, relation, Me., 174.

Milking—
machine experiments, S.Dak., 579.
machines, cleaning, U.S.D.A., 175.
process, discussion, 173.

Milkweed—
whorled, control, Colo., 530.
woolly-pod, poisonous to livestock, 583.

Miller's almanac, 530.

Millet—
breeding experiments, 735.
culture experiments, Mont., 430; U.S.D.A., 630.
culture in Morocco, 595.
fertilizer experiments, 329.
Japanese, variety tests, Mont., 129.
silage. (*See* Silage.)
smuts, control, 646.
Striga lutea affecting, 843.
variety tests, Can., 734; Nebr., 733; U.S.D.A., 630.

Millipedes affecting truck crops, Pa., 251.

Milo meal, feeding value, N.Mex., 869.

Milo smut, notes, 839.

Mineral—
requirements of dairy cattle, 72.
requirements of gilts on pasture, 871.
resources—
nonmetallic, of United States, 124.
of United States in 1921, 727.
supplements, effect on development of swine, Okla., 468.

Minerals for fattening pigs, Iowa, 774.

Minnesota—
State Live Stock Sanitary Board, report, 178.
State testing mill, activities and equipment, 831.
Station, notes, 196, 496.
University, notes, 196, 496. 899.

Mississippi—
College, notes, 299, 899.
Station, notes, 299, 600.
Station, Raymond Branch, report, 298.
Station, report, 495.
Stations, historical sketch, 495.

Missouri Poultry Station, notes, 496.

Missouri Station, notes, 196, 397.

Missouri University, notes, 196, 397, 799.

Mites, parasitic, handbook, 76.

Mitochondria, nature of, 819.

Moisture absorption of sugars, factors affecting, 613, 614.

Molasses—
ash determinations, 505.
beet pulp. (*See* Beet pulp.)
feeding value, Iowa, 870; Miss., 869; Nebr., 671.
feeds, composition and feeding value, 370.
utilization in manufacture of motor fuel, 387.

Mold fungi, utilization of organic substances by, 126.

Molds as affected by petroleum, 19.

Molds, growth, inhibiting effect of H-ion, OH-ion, and salt concentration, Iowa, 722.

Moldy bread outbreak, Wis., 660.

Mole, common, habits, 50.

Moles, burrowing habits, 250.

Moles, trapping, 756.

Molkenboden soils, chemical studies, 811.

Mollisia carliana, notes, N.C., 747.

Molybdenum in Hagerstown soil, 617; Pa., 210.

Monobelus fasciatus, notes, 550.
Monodontomerus dentipes, notes, 855.
Monolepta rosea, notes, 758.
Monophadnoides rubi. (*See* Raspberry sawfly.)
Monophlebinae, notes, 851.
Montana—
College, notes, 99, 900.
grain inspection laboratory work, Mont., 231.
Station, notes, 99, 900.
Station, report, 195.
Moor soils, liming experiments, 726.
(*See also* Peat soils.)
Morning-glory, wild, control, 136; Calif., 136.
Mortality as affected by restricted diet, 767.
Mosaic diseases, studies, Iowa, 746; Mich., 45.
(*See also specific host plants.*)
Mosquitoes—
malarial, of Illinois, studies, 156.
yellow fever, and dengue fever, 657.
(*See also* Anopheles.)
Moths, North American, revision, 254.
Motor—
cultivators. (*See* Cultivators.)
fuel, alcohol as, treatise, 286.
fuel, manufacture from waste molasses, 387.
fuel volatility, 887.
spirits and ethylite, 590.
transport performance with varied fuel volatility, 386.
trucks, heavy-duty drive axles, studies, 888.
trucks on Corn Belt farms, U.S.D.A., 185.
trucks, operating costs, 888.
Mottling disease of sugar cane. (*See* Sugar cane.)
Mouse typhoid—
infection, intestinal flora in, 79.
infection, manner and spread, 282.
infection, ox bile sensitization in, 79.
microbic virulence and host susceptibility, 281, 882.
Mowing costs, horse and power, 86.
Mowing machines, studies, Wis., 688.
Muck soils—
classification, Mich., 415.
fertilizer requirements, Mich., 19.
lime requirements, N.C., 724.
Mucor glomerula, growth inhibiting factors, Iowa, 722.
Mucor ramosus, notes, 381.
Mucormycosis in swine, 381.
Mulberry disease, cause, 350.
Mulches, value in preserving soil moisture, 317.
Mules, blood of, 683.
Mules, farm work, feeding, 69.
Mules, glycogen and glucose in muscles, 570.
Multiceps spalacis, notes, 400.
Mungo beans—
behavior and adaptation, Fla., 824.
returns from, in Georgia, 90.
variety tests, Guam, 426.
Muriate of potash. (*See* Potassium chlorid.)
Musca domestica. (*See* House-fly.)
Muscle protein, isoelectric point, 110.
Muscle tissue, determination of creatin in, 613.
Muscles of the extremities, sympathetic inervation, 378.
Mushroom diseases in England and Wales, 645.
Muskmelon downy mildew, notes, N.C., 747.
Muskmelon seed proteins, 714.
Muskmelons, spraying and dusting experiments, Va.Truck, 233.
Mustard, fertilizer experiments, 20.
Mustard for laying hens, Can., 70.
Mutation—
in man and incidence of hereditary traits, 567.
in *Nicotiana sylvestris*, 128.
new, in an inbred strain of Drosophila, 770.
papers on, 567.
studies, 24.
(*See also* Variation.)
Mutton autolysis, 11.
Mutton, cold storage holdings, U.S.D.A., 893.
Mutton, use in diet, U.S.D.A., 660.
Mycorrhiza in Ericaceae, 424.
Mycorrhiza in orchids, 424.
Myelois venipars n.sp., description, 155.
Myelois venipars, survey in Arizona, 452.
Myiasis in man and animals, Diptera causing, 55.
Myosin, isoelectric point, 110.
Myrmelachista ambigua ramulorum, notes, 550.
Myxosporium corticolum, notes, 44.
Myzus persicae. (*See* Peach aphid, green.)
Myzus ribis. (*See* Currant aphid.)
Naja bungarus, trematode from gall bladder, 499.
Najas marina, aquatic caterpillar on, 54.
Napier grass—
notes, Guam, 427.
palatability of silage from, Ga., 524.
Nasturtiums, culture, Alaska, 435.
Natada nararia, notes, 455.
National—
forests, trail construction, U.S.D.A., 790.
Lime Association, proceedings, 124.
parks, Canadian, report, 838.
Nature study outlines for rural schools, Calif., 195.
Navy beans, fumigated, hydrocyanic acid absorption and retention, U.S.D.A., 456.
Nebraska—
Potato Improvement Association, report, 34.
Station, notes, 99, 397.

Nebraska—Continued.
Station, report, 798.
University, notes, 99, 397.
Necrobacillosis, lesions in, 178.
Necrology, notes, 399.
Nectarines, new or noteworthy, N.Y.State, 338.
Nectarines, spraying experiments, Calif., 53.
Nectria cinnabarina, parasitism of, 649.
Nectria ditissima, notes, 44.
Nectria sp., notes, 540.
Nematodes—
affecting garden crops, 149.
leaf-and-stem infesting on strawberries, Oreg., 539.
of Barbary, natural history, 482.
Nematus erichsonii, studies, 454.
Neoarsphenamin, parasiticidal value, factors affecting, 479.
Nepheline, use as potassic fertilizer, 817.
Ness berry, new hybrid, Tex., 435.
Nest, trap, homemade, construction, 288.
Nests, trap, for ducks, 374.
Nettle, feeding value for poultry, 172.
Nettle silver-leaf, notes, 845.
Neurovaccine, persistence in organs of immunized animals, 782.
Nevada Station, report, 696.
Nevada University, notes, 99.
New England Standard Nine grades of fertilizer, use, 726.
New Hampshire Station, notes, 99, 600.
New Hampshire Station, report, 395.
New Hampshire University, notes, 99.
New Jersey Stations, notes, 197, 698.
New Mexico College, notes, 197.
New Mexico Station, notes, 197.
New Mexico Station, report, 599.
New York—
Cornell Station, notes, 698, 900.
State experiment stations, union of, 2.
State Station—
bulletins and periodicals available, 97.
list of projects, 97.
notes, 197, 497.
program of development, 97.
report, 97.
work and results, 798.
Newspaper, country, treatise, 595.
Nezara viridula, control, V.I., 352.
Nickel in plants, 520.
Nicotiana hybrids, partial sterility in, 25.
Nicotiana rustica, culture, 36.
Nicotin—
as a poultry vermifuge, 684.
determination in tobacco, 807.
dust, use against cucumber beetles, Wis., 760.
petroleum emulsion, insecticidal value, 758.
sulphate in dust carriers, Wis., 653.
volatility from insecticide dusts, N.Y. State, 551.
Nitrate—
accumulation in grassland as affected by phosphates, 21.
assimilation, rôle in oat dry spot, 840.
nitrogen, effect on wheat, U.S.D.A., 829.
of lime. (*See* Calcium nitrate.)
of potash. (*See* Potassium nitrate.)
situation, congressional hearings, 624.
Nitrates—
accumulation as affected by sulphur, Wash.Col., 215.
determination in soils, 309.
disappearance from soil under timothy, 321.
fluctuation in Gangetic alluvium, 322.
in soil, effect of straw, Wash.Col., 209.
leaching from soils, 419.
movements in soil and subsoil, 119.
nitrogen determination in, 12.
potential source, 123.
reduction by seed, 213.
relation to sod effect on apple trees, N.Y.Cornell, 235.
vertical distribution, 210.
Nitric—
acid, nitrogen determination in, 12.
nitrogen in soils, relation to concentration of soil solution, N.Mex., 515.
Nitrification—
as affected by gypsum, 727.
factors affecting, 210.
nature of, 419.
Nitrogen—
action of hexamethylentetramin, 123.
atmospheric, biological fixation, 119.
atmospheric, utilization by yeast, 819.
availability in soil, factors affecting rate, Mont., 116.
content of soil, factors affecting, N.Y. Cornell, 117.
determination—
in nitrates and nitric acid, 12.
in plant tissue extracts, 309.
use of persulphate in, 111.
effect on oats at different growth periods, 132.
fixation—
by nodule bacteria, energy requirement for, 812.
effect of calcium carbonate, 515.
effect of tree products on soil, Idaho, 213.
factors affecting, 18.
in Ericaceae, 522.
relation to soil acidity, Kans., 414.
studies, 117, 118.
fixing bacillus, new, 213.
lime. (*See* Calcium cyanamid.)
nonprotein, in goat's milk, 175.
studies, data, Oreg., 510.
Nitrogenous fertilizers—
comparison, 19, 20.
effect on chlorosis in rice, 754.

Nitrogenous fertilizers—Continued.
in France, 214.
organic-cake, relative nitrifiability, 122.
time and kind of application, 623.
time of application, 517.
Nitrometer method of determining nitrogen, 12.
Noctuidæ, physical ecology of, Minn., 758.
Nodule bacteria—
and chloroplasts, morphogenesis, 819.
effect of sunlight on longevity, Wash. Col., 223.
energy requirements for nitrogen fixation by, 812.
grouping, Wis., 626.
studies, 30.
Nodule formation by soy beans, 35. (*See also* Legumes, inoculation.)
Nodule-forming bacteria as affected by acid soils, 619.
Nodulicoccus, new genus, erection, 851.
North Carolina College, notes, 99, 497.
North Carolina Station, notes, 497.
North Carolina Station, report, 798.
North Dakota College, notes, 900.
North Dakota Station, notes, 497.
Nucleic acid, effect on plant growth, 815.
Nummularia discreta, notes, Iowa, 747.
Nursery—
inspection work in Kansas, 251.
practice, revolutionizing, 42.
stock, coniferous, snow molding in, 755.
stock, eradication of blotch from, Ind., 755.
stock, uniformity of fumigation requirements, 352.
Nutrient solutions—
pH value as affected by wheat seedlings, 627.
physiological balance in, 519.
Nutrition—
and health, suggestions, Ark., 364.
animal. (*See* Animal nutrition.)
during mental work, 561.
experiments, animal, Iowa, 772.
laboratory, report, 256.
modern science of, 762.
of pigeons, 160.
Pirquet system, critique, 856.
plant. (*See* Plant nutrition.)
project, local leadership in, 596.
relative protein-sparing action of carbohydrates and fats in, 362.
rôle of vitamin B in, 62.
use of proteins in, 158.
weight and height as index, 257.
(*See also* Diet, Metabolism, *and* Vitamins.)
Nymphs and adults, hard shell, control, 152.
Nymphula sp., aquatic caterpillar of, 53.
Nysius vinitor, notes, 758.
Oak mildew, studies, 446.
Oak silver-leaf, notes, 845.
Oaks, breeding experiments, Tex., 435.
Oat—
and pea silage. (*See* Silage.)
and tare silage. (*See* Silage.)
crown rust, studies, Ga., 541.
dry spot, cause, 840.
hay, culture, Alaska, 491.
leaves, injury due to nitrate assimilation, 840.
loose smut infection, relation to soil factors, 749.
pasture, hogging down, La., 271.
seeds, iron and manganese content, 202.
smut, control, 645.
smut, covered, control, Wash.Col., 241.
smut, treatment, Okla, 542.
straw, sugars and albuminoids of, 65.
Oats—
and barley, culture, Alaska, 491.
and peas as silage and soiling crop, Oreg., 526.
and peas, culture experiments, Mont., 430.
and peas, seeding experiments, Mont., 430.
as affected by potash, 816.
as affected by weather, 115.
as emergnecy hay crop, Wis., 629.
as nurse crop, 736.
breeding experiments, Idaho, 732; Miss., 428; Oreg., 525; Tex., 429.
classification, relation to variety tests, 827.
cost of production, Ind., 592; N.Y. Cornell, 691.
culture experiments, 329; Can., 734; Okla., 414; Oreg., 525; Tex., 429.
culture in Morocco, 595.
culture, rotation v. continuous, Okla., 433.
effect of nitrogen at different periods of growth, 132.
effect of preceding crop, Mont., 129; Nebr., 527.
effect on following crop, Mont., 129; Ohio, 329.
exudate water from, solids in, N.Y. Cornell, 520.
fertilizer experiments, 329; Ga., 524.
for hay, variety tests, Can., 734.
Japan, yields, Pa., 223.
lodging, factors affecting, Wis., 629.
manuring experiments, Can., 734.
method of feeding to poultry, Idaho, 777.
natural hybrids in, 529.
nickel in, 520.
production in United States, statistical study, U.S.D.A., 389.
production, trade, and foreign competition in, 794.
protein composition, factors affecting, 821.
Puccinia graminis on, biologic forms, 840.
purchasing power, Nebr., 292.
rotation experiments, Ohio, 725; Oreg., 526.

Oats—Continued.
seeded on corn, effect of residual manure, Mont., 130.
seeding experiments, Can., 734; Ohio, 733.
side, new classification, 133.
time of cutting tests, Can., 734.
toxic limit of alkali for, 513.
v. corn, feeding value, 69.
varieties, Ga., 524; Iowa, 732; Wis., 629.
varieties, description, U.S.D.A., 825.
varieties of Australia, classification and description, 736.
varieties, yielding capacity, 827.
variety tests, 31, 232, 329, 825; Alaska, 426; Can., 734; Idaho, 732; Kans., 427; Ky., 525; Miss., 428; Mont., 129; N.Mex., 525; Ohio, 733; Okla., 428; Oreg., 525; Pa., 223; Tex., 429; U.S.D.A., 825; Wash.Col., 224; Wyo., 429.
yields, Mont., 130.
yields, under livestock and grain systems, S.Dak., 528.
Ochromeigenia ormioides, description, 453.
Ohio Experiment Station, monthly bulletin, 798.
Ohio State University, notes, 198, 497, 698, 900.
Ohio Station, monthly bulletin, 298, 395, 696.
Ohio Station, notes, 198, 497.
Ohio Station, report, 395.
Oidiomycosis, bovine, 377.
Oidiopsis sp., notes, 839.
Oil—
cake, ammonification and nitrification experiments, 118.
content of soy beans, Ohio, 308.
lubricating, for control of San José scale, 355; Mo., 253; U.S.D.A., 354.
lubricating, friction testing, 387.
meal. (*See* Linseed meal.)
palm and products of West Africa, 342.
palm disease, notes, 540.
palms and fruit, 141.
palms, breeding experiments, 735.
Oils—
analysis, treatise, 608.
crude, for orchard heating, Oreg., 533.
edible, losses in refining, 311.
edible, vitamin A content, 59.
hydrogenated, coefficients and digestibility, 560.
hydrogenated, industrial uses, 507.
miscible, for fruit tree leaf roller, tests, Mont., 852.
oxidized, engine experiments, 387.
vegetable, for motor fuel, 590.
vegetable, mixtures, analysis, 611.
(*See also* Fats, Corn oil, Cottonseed oil, *etc.*)
Oklahoma College, notes, 600.
Oklahoma Station, report, 495.
Oleomargarin. (*See* Margarin.)
Olethreutidæ—
new, from eastern United States, 760.
revision, 254.
Olives—
abnormality of blossoms, 40.
breeding experiments, 735.
leaves and fruits, *Bacillus botulinus* on, 861.
Oncocerca cervicalis, notes, 284.
Oncopeltus quadriguttatus, notes, 758.
Onion—
maggot, summary, Oreg., 255.
smudge, resistance to, 843; Wis., 644.
smut, control, Oreg., 538.
thrips, control, Wis., 653.
Onions—
nickel and cobalt in, 520.
time of flower primordia formation in, 137.
toxic limit of alkali for, 513.
Ontario Agricultural and Experimental Union, 825.
Oospora lactis, notes, 845.
Oospora pustulans, notes, 44, 47.
Oospora scabies. (*See* Potato scab.)
Ophiobolus cariceti, notes, Kans., 443.
Ophiobolus graminis, notes, 541.
Ophthalmia, pathological anatomy produced by unfavorable diets, 461.
Orange—
basket worm, unusual outbreak, 759.
brown rot, control, 150.
groves of Spain, diseases and pests, 438.
juice in diet of underweight children, effect, 662.
juice, vitamin A in, 769.
pest, new, in Arizona, 155.
rust, notes, Oreg., 546.
scaly bark, studies, 847.
trees, effect of sodium and calcium chlorid, Calif., 628.
trees, growth and composition in sand and soil cultures, 729.
worm, studies, 452.
Oranges—
culture experiments, Tex., 436.
export from South Africa, 249.
pruning, Calif., 641.
Satsuma, coloring in Alabama, U.S.D.A., 743.
Orchard—
fire blight, control, 149.
grass, breeding experiments, Idaho, 732.
grass, culture experiments, 735.
grass seed, marketing, Ky., 892.
horse disease, Wash.Col., 278.
inspection. (*See* Nursery inspection.)
Orchards—
cover crops for, Oreg., 534; Wash. Col., 232.
fertilization, N.Y.State, 534, 535.
fertilizer experiments, Oreg., 532; Pa., 232; Wash.Col., 232.
heating experiments, N.Mex., 532.

Orchards—Continued.
heating, tests of crude oils, Oreg., 533.
insect control in, 152.
management studies, Can., 832.
productivity, relation to temperature, U.S.D.A., 314, 337.
sod mulch v. tillage, Ohio, 337.
soil management studies, Mont., 833.
(*See also* Fruits, Apples, Peaches, *etc.*)
Orchestes pallicornis, outbreak, 885.
Orchid mycorrhiza, 424.
Oregon College, notes, 498.
Oregon Station, report, 599.
Organic—
acids, effect upon uric acid excretion, 858.
compounds—
analysis and determination of constitution, 501.
determination of sulphur in, 203.
effect on starch hydrolysis, 10.
matter—
and sulphur content of soil, correlation, Ill., 315.
determination in soil, 804.
effect on hardpan subsoil, Okla., 420.
in soil, effect of rainfall, Wash. Col., 211.
in soil, factors affecting, N.Y. Cornell, 117.
in soil, relation to color, Iowa, 318.
Organisms—
atypical, in poultry, R.I., 81.
decomposition of kaolin by, 212.
in cultivated soils, 212.
(*See also* Bacteria *and* Microorganisms.)
Oriental moth, parasite of, 657.
Oriental peach moth. (*See* Peach moth.)
Ornamental plants, shrubs, or trees. (*See* Plants, Shrubs, *and* Trees.)
Ornithin, synthesis in fowls, 661.
Ornithodoros megnini, review of literature, 455.
Ornithodoros spp., notes, 157.
Orthoclase—
potassium in, availability, Pa., 215.
use as potassic fertilizer, 817.
Oryctes rhinoceros, notes, 50.
Osmotic concentrations of ligneous and herbaceous plants, 26.
(*See also* Sap.)
Osteomalacia in cattle, 179.
Ostertagia ostertagi, notes, 786.
Ostræa bengalensis, notes, 154.
Otiobiosis, review of literature, 455.
Otiobiosis, studies, 157.
Otiobius megnini—
review of literature, 455.
studies, 157.
Otiorhynchus ovatus, control, 848.
Otiorhynchus sulcatus, notes, 50.
Otosclerosis, notes, 462.
Ovary, bovine, anatomical development, 781.
Owl, little, food of, 251.
Ox bile sensitization in mouse typhoid infection, 79.
Ox blood, nature of sugar in, 715.
Ox, edible tissues, vitamin B in, U.S.D.A., 63.
Ox warbles, control, 657.
(*See also* Bots.)
Oxalic acid determination in fruit juices, 805.
Oxalidaceæ-Turneraceæ of Mexico, 837.
Oxen, care in health and disease, 377.
Oxidation in soil-forming rocks, effect of chemical agents, 617.
Oxycarenus luctuosus, notes, 758.
Oxygen—
and perforations in canned fruits, 856.
consumption, effect of vitamin deficiency, 767.
Ozonium omnivorum, studies, 246; Tex., 442.
Pachymerus sp., parasite of, 256.
Pachynematus clitellus, notes, 256.
Pachyzancla periusalis—
affecting tomatoes, 759.
notes, 53.
Paddy. (*See* Rice.)
Paint, plasticity, 287.
Paints, tests, 385.
Palatoeceticus gloverii, unusual outbreak, 759.
Palm, coconut. (*See* Coconuts.)
Palm oil as motor fuel, 590, 688.
Palm oil, vitamin A in, 59.
Palms, oil, and fruit, 141.
Panama climate, U.S.D.A., 719.
Pancreatic secretion and acid tide, 560.
Pandora moth, notes, 655.
Panicum frumentaceum, smut affecting, 839.
Papaipema nitela. (*See* Stalk borer.)
Papaya, vitamin C in, 563.
Para grass, effect on coconut, Guam, 427.
Paraclemensia acerifoliella, studies, N.Y. Cornell, 355.
Paradexodes epilachnae n.sp., description, 453.
Paradichlorobenzene for peach borer control. 152; Ind., 548; Ky., 549; Mo., 555; N.Y. State, 53; Okla., 450; U.S. D.A., 851.
Paragonimus compactus, redescription, 499.
Paragonimus, genus, notes, 499.
Paralysis, partial, in swine, prevention, Ohio, 371.
Parashorea malaanonan wood, properties, 143.
Parasites—
and parasitic diseases of sheep, U.S.D.A., 786.
animal, diseases caused by, treatise, 177.
internal, diagnosis and treatment, 482.
of animals in slaughterhouse, La., 283.
oscillary, of intestines of man and animals, 400.
(*See also* Animal parasites *and specific forms.*)

Parasitism, physiology of, studies, 240.
Parasitology, atlas of, 177.
Parasitology, handbook, 76.
Paratetranychus pilosus, studies, Ohio, 352.
Paratyphoid-enteritidis in mice, microbic virulence and host susceptibility in, 882.
Paria canella, control, 658.
Paris green as anopheline larvicide, 55.
Parmelia molliuscula, chemical examination, Wyo., 476.
Parsnips, culture experiments, Alaska, 435.
Paspalum, methods of propagation, Guam, 427.
Pasteurella oviseptícum, notes, 681.
Pasteurization. (*See* Milk *and* Cream.)
Pastoral life in French Alps, 390.
Pasture—
  mixture, notes, Oreg., 526.
  plants as affected by grazing, U.S.D.A., 866.
  soils of upper Jura, flora and fertilizers, 511.
Pastures—
  dry land, feeding value, Mont., 170.
  dry land, for hogs, U.S.D.A., 371.
  effect of burning, 224.
  fertilizer experiments, Ohio, 733.
  improvement studies, N.H., 329; Ohio, 329.
  irrigated, carrying capacity, U.S.D.A., 875.
  mowing experiments, U.S.D.A., 867.
  seeding method, U.S.D.A., 630.
  studies, Can., 734; Miss., 428.
  v. soiling for cows, Mont., 172.
  (*See also* Grasses *and* Meadows.)
Pathology, exotic, 499.
Pavements. (*See* Concrete *and* Roads.)
Pea and oat silage. (*See* Silage.)
Pea aphid, control, Wis., 653.
Pea meal as source of protein for hens, Idaho, 777.
Pea root tips, excised, cultivation under sterile conditions, 627.
Pea seeds, iron, and manganese content, 202.
Pea seeds, manganese content, 731.
Peach—
  aphid, green, toxicity of tobacco dust to, N.Y.State, 552.
  aphids, control by soap, N.C., 757.
  borer, control, 152; Ind., 548; Ky., 549; Mo., 555; N.C., 757; N.Y. State, 53; U.S.D.A., 851.
  borer, control methods, Okla., 450.
  borer, emergence records in Pennsylvania, 852.
  brown rot, control, Conn.State, 534.
  brown rot, notes, 45, 442, 445.
  buds, undercooling, 220.
  canker, control, Can., 839.
  curculio, notes, N.C., 757.
  diseases, parasitic, during 1915–1920, 445.
  leaf curl, control, N.Y.State, 49.
Peach—Continued.
  leaf curl, notes, 442, 445.
  mite, notes, Pa., 251.
  moth, oriental, in France, 555.
  orchards, soil treatment experiments, Ill., 336.
  rootstock, identification, Calif., 637.
  rosette, studies, 648.
  scab, control, Conn.State, 534.
  silver-leaf, notes, 845.
  trees, composition, effect of shading and ringing, N.H., 741.
  twig moth, summary, Calif., 53; Oreg., 254.
Peaches—
  breeding experiments, 436.
  culture in Ohio, Ohio, 340.
  dusting v. spraying, Conn.State, 534.
  espalier-grown, effect of wall color on ripening date, 39.
  multiple fruit formation in, 438.
  new or noteworthy, N.Y.State, 338.
  pruning experiments, N.Y.Cornell, 638.
  spray schedules for, N.J., 138.
  spraying and dusting experiments, N.Y.State, 49.
  spraying experiments, Calif., 53; N.J., 349.
  spreader tests on, 353.
  thinning, Calif., 235.
  time of fruit bud differentiation, 834.
Peanut—
  bacterial wilt, studies, 246.
  flour, supplementary protein value, 361.
  meal protein, nutritive value, 865.
  oil analysis, 611.
  oil, losses in refining, 311.
  press cake sauce, manufacture, U.S.D.A., 312.
Peanuts—
  and peanut meal, feeding value, Ga., 578.
  breeding experiments, 735; Fla., 824.
  culture experiments, Tex., 429.
  effect on production of soft pork, Fla., 873.
  returns from, in Georgia, 90.
  variety tests, Guam, 427; Tex., 429.
  yield as affected by methods of propagation, Guam, 427.
Pear—
  black spot, control, 546.
  blight resistance studies, Oreg., 546.
  blight, resistant variety, Ky., 531.
  by-products, utilization, Calif., 206.
  candy, preparation, Calif., 206.
  canker, European, control, Oreg., 539.
  chlorosis, control, 755.
  diseases, parasitic, during 1915–1920, 445.
  fire blight, notes, 44, 442.
  fire blight, resistant variety, Ga., 537.
  mildew epidemic of 1921, 445.
  psylla, control, N.Y.State, 52.
  psylla problems, 152.
  rosette, studies, Wash.Col., 755.

Pear—Continued.
sirup, preparation, Calif., 206.
spread, preparation, Calif., 206.
trees, chlorotic, restoring, 755.
vinegar, preparation, Calif., 206.
Pears—
calyx spray, formula, Conn.State, 742.
cull, utilization, Calif., 206.
culture experiments, Oreg., 533.
in New York, N.Y.State, 340.
new or noteworthy, N.Y.State, 338.
pineapple, notes, Ga., 531.
pollination experiments, Oreg., 534.
relation of pruning to fruit bearing, N.Y.Cornell, 638.
spray schedules for, N.J., 138.
spraying experiments, 153; N.Mex., 154; Oreg., 546.
storage experiments, 437.
time of fruit bud differentiation, 834.
time of picking studies, Oreg., 533.
Peas—
and oats—
as silage and soiling crop, Oreg., 526.
culture experiments, Mont., 430.
seeding experiments, Mont., 430.
as affected by potash, 817.
as orchard cover crop, Mont., 833.
breeding experiments, 329; Idaho, 732.
culture directions, Oreg., 133.
culture experiments, Alaska, 426, 435.
feeding value, Idaho, 774.
field, as emergency hay crop, Wis., 629.
field, varieties, Mont., 430.
for hay, variety tests, Can., 734.
green, net weight in pods, Can., 832.
inheritance of rogue type in, 741.
rotation experiments, Oreg., 526.
seeding experiments, Idaho, 732.
Tangier, seeding experiments, Oreg., 525.
use as cover crop, Mont., 136.
varieties, Wis., 629.
variety tests, Can., 734; Idaho, 732; Wash.Col., 224.
Peasant class, rise, in Europe, treatise, 191.
Peat—
dust, use in latrines and privies, 818.
excrement mixture, fertilizing value, 818.
lands, first breaking experiments, 686.
litter and mull, manufacture, 818.
litter, use in stables, 818.
mull as fertilizer filler, 818.
resources of United States, 124.
soils, effect on concrete tile, 790.
soils, lime requirements, N.C., 724.
(*See also* Moor soils.)
Pecan scab, control, Miss., 441.
Pecans, culture experiments, N.Mex., 532.
Pecans, variations in, 140.
Pectin—
and pectic acid, relation in fruits, 48.
Pectin—Continued.
content of fruit juice, determination, Hawaii, 411.
Pectinase production, effect of substrate and pH value, 729.
Pectinophora gossypiella. (*See* Cotton bollworm, pink.)
Pectins, extracting, household methods for, U.S.D.A., 114.
Pediculopsis graminum, notes, 455.
Pegomyia brassicae. (*See* Cabbage maggot.)
Pegomyia hyoscyami, control, 156.
(*Pegomyia*) *Phorbia cepetorum.* (*See* Onion maggot.)
Pellagra, etiology, 263.
Penicillium—
expansum, notes, 49.
glaucum, sources of sulphur for, 26.
spp., growth inhibiting factors, Iowa, 722.
spp. spore germination, effect on acidity, 125.
Pennisetum setosum, notes, Guam, 427.
Pennsylvania—
College, notes, 99, 198, 498, 900.
State Veterinary Medical Association, proceedings, 782.
Station, notes, 498, 900.
Station, report of director, 298.
Pentalonia nigronervosa, notes, 451.
Pentosans, distribution in corn plant, 201.
People's Commissariat of Agriculture, activity, 292.
Pepino, vitamin C in, 563.
Pepper—
diseases, Ga., 346.
maggot, studies, N.J., 356.
seed sterilization tests, Ga., 346.
seedlings, damping off, prevention, Ga., 347.
wilt, cause, 648.
Peppers, fertilizer experiments, Ga., 531.
Pepperwort, hoary, eradication, 831.
Peptone, autolized, effect on growth of excised corn root tips in dark, 627.
Perfumes, production in French colonies, 389.
Periconia pycnospora, description, 445.
Peridermium strobi. (*See* White pine blister rust.)
Perilitus eleodis, notes, Nebr., 659.
Peronospora effusa, notes, Tex., 442.
Peronospora trifoliorum, notes, 542.
Persimmons, Chinese, vitamin C in, 563.
Pestalozzia guepini, demonstration of numerous strains, 523.
Petroleum, effect on soil flora, 19.
Phagocytosis, effect of vitamin deficiency, 280.
Phalaris bulbosa, fungi on, 445.
Pharmaceutical analysis, treatise, 407.
Phasiops flava, notes, 657.
Phenols, monohydric, determination, 311.
Phlegethontius sexta jamaicensis, notes, 53.
Phlyctaenodes stictalis, life history and habits, 253.

Pholus achemon, studies, 154.
Phoma destructiva, notes, Ga., 346.
Phoma liniperda n. sp., description, 45.
Phoma pomi, control, Ohio, 648.
Phoma spp., notes, 149, 548.
Phomopsis—
citri, notes Fla., 838.
citri, temperature relations of growth, 540.
pseudotsugae affecting Japanese larch, 446.
vexans, notes, Va.Truck, 233.
Phorbia cepetorum. (*See* Onion maggot.)
Phorbia rubivora, notes, Oreg., 555.
Phosphate—
content of blood of infants, 58.
effects on early growth and maturity, 726.
fertilizer situation in Germany, 517.
fertilizers, studies, Wis., 622.
neutral, description, 517.
rock resources of United States, 124.
rock, solubility studies, 118.
Trichinopoly, for rice, 124.
Phosphates—
comparison, 623, 816; Ky., 516; Oreg., 510; Pa., 214.
disaggregated, fertilizing value, 816.
flour and bone meal, comparison, 123.
ground mineral, fertilizing value, 214.
insoluble, valuation, 202.
rock, fertilizing value, 20.
substitutes for, 215.
(*See also* Superphosphate.)
Phosphatic—
depletion in Bihar soils, theory concerning, 815.
fertilizers, comparative availabilities, 123.
slag, accessory elements of, 215.
slag, fertilizing value, 20.
slag, relation to compounds in lime phosphoric acid system, 214.
(*See also* Phosphates, comparison.)
Phosphoric acid—
ammonia and potash, proportions for fertility, Ohio, 323.
available in soil, determination, 111, 203.
determination in fruit juices, 805.
effect on maturity of tomatoes, 234.
fertilizers, shortage in Germany, 215.
fertilizing value, 815.
fixation by soil, Tex., 320.
in cane juices, 120.
of blood, during mental work, 560.
solution, effect on bud growth of cuttings, 834.
supply of German soils, 624.
test for, 407.
Phosphorus—
content of—
St. Joseph Co., soils, Mich., 16.
soils, determination, 420.
tomatoes, 436.
effect on tomatoes, N.H., 336.
Phosphorus—Continued.
fertilizing value, S.Dak., 510.
inorganic, in blood of children, 764.
inorganic, of serum and plasma of adults, 363.
organic, determination, 112.
organic, in soils, 815.
requirements of live stock, Wis., 167.
requirements of soils, determining, 815.
studies, data, Oreg., 510.
Photoperiodism—
in wheat development, Wash.Col., 223.
studies, 326.
Photosynthesis—
and electronic theory, 519.
in plants, studies, 728.
of plant products, 820.
sap density, and water requirements, correlation, 536.
Photosynthetic efficiency, 29.
Phragmidium imitans, notes, 44.
Phthia picta, control, V.I., 353.
Phthorimaea operculella, notes, 53.
Phyllocoptes cornutus, notes, Pa., 251.
Phyllophaga spp., studies, Miss., 454.
Phyllosticta—
cicerella, notes, 45.
nicotiana, notes, Fla., 838.
solitaria, control, Ind., 754.
theobromae, notes, 540.
Phyllostictina carpogena, origin of cavity in pycnidia, 349.
Phyllostylon braziliensis wood, present uses, 143.
Phylloxera—
problem, 50.
protection of grapevines from, 655.
Physalospora—
baccae, studies, 547.
miyabeana n.sp., notes, 548.
phalaridis n.sp., description, 445.
Physarum viride rigidum plasmodium, habitat, 242.
Physiology—
chemical, treatise, 358.
human, biochemistry in relation to, treatise, 559.
Phytamoeba sacchari, proposed name, 444.
Phytobacter lycopersicum, notes, 149
Phytophthora—
cinnamomi n.sp., description, 150.
faberi, notes, 540.
infestans, conidia, bionomics of, 844.
(*See also* Potato blight, late.)
spp., notes, 45.
terrestria—
notes, 44, 650; Calif., 649.
temperature relations of growth, 540.
Phytophthora—
in soil, saprophytic life, 242.
rot, control, 839.
Pigeon peas, variety tests, Guam, 426.
Pigeons, flesh of, feeding experiments, 358.
Pigeons, nutritive requirements, 160.
Pigeons, raising, manual, 297.

Pigmentation. (*See* Anthocyan *and* Color inheritance.)
Pigments, brown, formation in plants, 26.
Pigs—
Berkshires v. Yorkshires, Can., 68.
best breeds for bacon, 470.
breeds and crosses, relative growth, 270.
breeds, comparison in Denmark, 170.
care and management, 270.
care in health and disease, 377.
cost and rate of gain as affected by ration, Okla., 469.
cost of production, Ind., 592.
cost of raising, La., 271.
crossbreds, value, 170.
edible tissues, vitamin B in, U.S.D.A., 63.
effect of prolonged maintenance on subsequent growth, 872.
effect of protein and mineral feeds, Okla, 468.
fattening experiments, Wyo., 470.
fattening on pasture and in pen, 372.
feed requirements and costs, Can., 68.
feeding and care, 297.
feeding experiments, 68, 168; Fla., 873; Idaho, 774; Ind., 571; Iowa, 772, 774; Ky., 571; Miss., 469; Mont., 170; N.C, 775; Nebr., 775; Ohio, 370; Oreg., 572; Pa., 271; Tex., 469; U.S.D.A., 872; Wash. Col., 270; Wis., 672.
(*See also* Sows, brood.)
finishing for market, Oreg., 373.
industry in Hawaii, Hawaii, 572.
inheritance in, Pa., 269.
inside v. outside feeding methods, Can., 68.
nutritional experiments, Ill., 368.
parasites and diseases, Hawaii, 573.
pasturing experiments on dry land crops, U.S.D.A., 371.
production and marketing, U.S.D.A., 373.
protein supplements for, Mich., 469.
raising, instructions for boys and girls, 195.
self-feeders for, design, Iowa, 572.
self-feeders for, kind and amount of feeds, 169.
self-feeding v. hand-feeding, Pa., 271.
size, sex, and weight per litter, Ky., 573.
suckling, feeding experiments, Can., 67.
type tests, 775.
Yorkshires v. Berkshires, Can., 68.
(*See also* Sows *and* Swine.)
Piima or Fiili, ropy milk organism from, 678.
Pilocarpin, effect on deficiency disease in pigeons, 769.
Pine—
blister rust. (*See* White pine blister rust.)
longleaf, effects of turpentining, 238.
Pine—Continued.
needle scale, notes, 50.
sawfly, European, parasitism of, 855.
Scotch, as nurse crop, 743.
Scotch, seed production in relation to temperature, 744.
second-growth slash, effects of turpentining, 238.
seeds, Scotch, experiments with, 142.
shortleaf, growth, 342.
species in Southern Hemisphere, 836.
western yellow, natural reproduction, U.S.D.A., 641.
western yellow, rate and nature of decay in, U.S.D.A., 43.
(*See also* White pine.)
Pineapple—
pear, notes, Ga., 531.
waste, dried, feeding value, 169.
Pineapples—
fertilizer experiments, Guam, 435.
insects affecting, 448.
Pink bollworm. (*See* Cotton bollworm, pink.)
Pinworms, control, 77.
Pipe, friction heads in, calculating, 284.
Pipe, sizes, new charts for calculating, 685.
Piroplasmosis in Morocco, 181.
Pirquet feeding system, critique, 856.
Pisédeterre construction, 586.
Pissodes strobi, control, 761.
Pituitary gland substance, feeding value, Can., 70.
Plant—
breeding experiments. (*See special crops.*)
breeding, handbook, 735.
Breeding Institute of University of Cambridge, 493.
(*See also* Heredity, Hybridization, *and specific plants.*)
cell walls, semipermeability in, 218.
cells, H-ion concentration, 520.
cells, rhythmic precipitation phenomena in, 218.
chromosomes. (*See* Chromosomes.)
communities of a sand ridge region, development, 629.
disease laws in British Empire, 540.
disease survey, Wash.Col., 242.
diseases—
and immunity, 442.
and pests in Dutch East Indies, 144.
in Canada, 442.
in England and Wales, 645.
in Gembloux, 540.
in Indiana, 144.
in Netherlands, 242.
in Norway, 645.
in Switzerland, 144.
prevention, 442.
relation to soil temperature, 240.
(*See also* Fungi *and different host plants.*)
food adsorption by colloidal silica, 17.

Plant—Continued.
food constituents as affected by irrigation and drainage, N.Mex., 886.
growth and composition as affected by light, 739.
growth as affected by nucleic acid, 815.
growth, effect of the moon, 115.
indicators, 128.
inspection. (*See* Nursery inspection.)
juices in contact with soil lime, acidity, 121.
lice affecting truck crops, Pa., 251.
life and growth, treatise, 836.
nutrition, an electrical phenomenon, 519.
pathology and chemotherapy, 839.
pathology, present status in agriculture, 240.
pest laws in British Empire, 540.
production quadrats, 29.
protectives, tests, 540.
succession and soil reaction, 417.
tissue—
extracts, nitrogen determination in, 309.
fluids, physico-chemical properties, 24.
laticiferous, origin and nature, 29.
tissues—
H-ion concentration values, 520.
preserving methods, 9.
vitamin A formation in, 767.
volatile substances from, effect on spore germination, 240.

Plants—
anthocyan formation in, 26.
biochemistry of, treatise, 218.
carbon dioxid fertilization, 216.
cell division hormones in, 219.
climax formations, 30.
colonial, breeding, 735.
cultivated, degeneration in, 822.
curvature-producing substances in, 127.
distribution, effect of pH values, 618.
effect of ages of parents on dominance of characters in progeny, 222.
erectness of, 219.
fiber. (*See* Fiber plants.)
flowering, culture, Can., 832.
(*See also* Plants, ornamental.)
grafted, migration of principles in, 822.
halophyte, germination and growth, effect of salinity of water, 730.
imports, U.S.D.A., 128, 426, 523.
injury from electrochemical works, 222.
intergradation in, 29.
leaf structure and transpiring power, 28.
leaf water content, 521.
magnesia injury to, 628.
manganese distribution in, 221.
manganese requirements, 730.
medicinal. (*See* Drug plants.)
occurrence of rarer elements in, 617.

Plants—Continued.
of Indian Desert, physiological anatomy, 218.
ornamental, for landscape planting, 439.
osmotic concentration and electrical conductivity, 26.
photosynthesis. (*See* Photosynthesis.)
poisonous to livestock, Ind., 584; Nev., 582, 583; U.S.D.A., 583; Wyo., 476.
poisonous to stock and first aid, 177.
(*See also* Livestock poisoning *and specific plants.*)
pollination. (*See* Pollination.)
respiration. (*See* Respiration.)
root-forming substances in, 127.
sexual reproduction, importance of length of day, 326.
succulent, culture and propagation, 836.
symbiosis in, 819.
toxicity of borax for, 217.
toxicity of smelter emanations for, 127.
transpiration. (*See* Transpiration.)
transplant quadrats and areas, 30.
tumor-like formations in, 820.
variability in, new type, 567.
variation. (*See* Variation.)
variegation in, 128.
vascular, developmental selection, 425.
volunteer, parasites in, 839.
wilting, 521.
woody. (*See* Woody plants.)

Plasmodiophora brassicae. (*See* Cabbage clubroot.)
Plasmodiophora vasculorum, studies, 539.
Plasmopara cubensis, notes, N.C., 747.
Platycoelostoma, new genus, erection, 851.
Platyedra gossypiella in South India, 556.
Plectodiscella veneta, control, Iowa, 746.
Pleospora herbarum, description, 445.
Plesispa reichei, notes, 658.
Pleuropneumonia, bovine, in East Africa, 785.
(*See also* Influenza, equine, *and* Pneumonia.)
Pleuroprucha insulsaria, notes, 154.
Plowing, deep plowing, and subsoiling, comparison, Ohio, 388.
Plows, garden hand, tests, 486.
Plows, important improvement in, 486.
Plows, tests for first breaking of peat lands, 686.
Plum—
bacterial infection, 44.
curculio in Georgia, studies, 659.
curculio, notes, N.C., 757.
diseases, parasitic, during 1915–1920, 445.
shoot wilt and canker, studies, 248.
silver-leaf, notes, 845.
stocks, test, N.Y.State, 38.
Plums—
blossom bud formation, effect of defoliation, Wis., 140.

Plums—Continued.
breeding experiments, S.Dak., 533.
pollination experiments, Calif., 40.
relation of pruning to fruit bearing, N.Y.Cornell, 638.
self-sterility and cross-incompatibility in, 234.
spray schedules for, N.J., 138.
stocks for, N.Y.State, 340.
time of fruit bud differentiation, 834.
varieties, Mont., 136.
Plusia rogationis, notes, 53.
Pneumococcus—
antigen, nature of, 880.
immunity, studies, 880.
Pneumonia—
contagious, etiology, 684.
equine. (*See* Influenza, equine.)
in calves, Calif., 79.
in sheep, bacteriologic study, 681.
in sheep, diplococcus associated with, 786.
progressive, of sheep, Mont., 178.
(*See also* Pleuropneumonia.)
Pnyxia scabiei, notes, 254.
Podontia 14-punctata, notes, 255.
Podosphaera oxyacanthae, parasitic Cicinnobolus in, 145.
Podsol soils, morphological studies, 117.
Poha, jellying properties, Hawaii, 411.
Poison bait for European earwig, 850.
Poisonous plants. (*See* Livestock poisoning, Plants, poisonous, *and specific plants.*)
Poliomyelitis, relation to insects, 450.
Pollen grains in the upper air, 747.
Pollination—
natural cross, in soy beans, 425.
studies, 29.
(*See also specific plants.*)
Polychrosis viteana. (*See* Grape berry moth.)
Polydactylism in horses, 165.
Polyembryony in *Poa pratensis,* 528.
Polyneuritis—
effect of tyramin on, 462.
in pigeons—
as affected by adrenalin, 769.
as affected by atropin, 769.
as affected by pilocarpin, 769.
disturbance in cellular metabolism, 766.
studies, 358, 359.
(*See also* Vitamin B.)
Polyphenols, detecting, 805.
Polyporus schweinitzii on Douglas fir, U.S.D.A., 755.
Polysaccharids, monograph, 803.
Polyspora lini, n.g. and n.sp., description, 543.
Pomegranate beverage, preparation, Calif., 412.
Pomology, commercial, disease factor in, 845.
Pontia spp. (*See* Cabbage worms.)
Popcorn varieties, Mich., 432.
Popcorn, variety tests, 329.
Popillia japonica—
flies parasitic upon, 453.
larvæ in golf greens, control, 657.
spread, 854.
Poplars in Europe, 837.
Poplars, use against drifting sand in drainage ditches, Mich., 439.
Population, relation to agriculture, 568.
Populist movement in Georgia, 93.
Poria hypobrunnea, notes, 652.
Pork—
cold storage holdings, U.S.D.A., 893.
production, value of first cross in, 170.
(*See also* Pigs.)
products, curing, English methods, 470.
quality as affected by feed, 68.
soft, studies, Fla., 873; Ga., 573; Miss., 469; N.C., 775.
Porosagrotis orthogonia—
control, Mont., 251.
forecasting outbreaks, 155.
meterological relations, Minn., 759.
Porthetria dispar. (*See* Gipsy moth.)
Porto Rico—
Federal Station, notes, 299, 698.
Insular Station, notes, 498.
Insular Station, report, 599.
University, notes, 299.
Portulaca, inheritance of special traits, 24.
Posts supporting agricultural electric wires, creosoting, 485.
Pot culture experiments, error in, 120.
Potash—
ammonia, and phosphoric acid, proportions for fertility, Ohio, 323.
deposits of Alsace, 517.
determination in soil, 111.
effect on development and composition of crops, 816.
fertilizers, use, 817.
fertilizing value, La., 824.
field in western Texas, 817.
resources of United States, 124.
sources and uses in agriculture, 517.
studies, 623; Oreg., 510.
Potassium—
ammonium nitrate, fertilizing value, 20, 623.
arsenite, toxic dose for dogs, 381.
availability as affected by soil bacteria, Ky., 516.
chlorid, feeding experiments, Iowa, 773.
chlorid, fertilizing value, 623, 825; Ohio, 724.
content of rain water, 413.
cyanid, insecticidal value for nursery stock, 451.
fertilizers, effect on barley, 631.
in animal nutrition, 464, 568.
in orthoclase, availability, Pa., 215.
magnesium sulphate, fertilizing value, 623.
nitrate, fertilizing value, 815.
oxalate, effect on copper reducing power of sugars, 716.

Potassium—Continued.
permanganate solution, effect on bud growth of cuttings, 834.
persulphate, use in nitrogen determination, 111.
phosphate, Schroeder's, fertilizing value, 21.
sulphate, fertilizing value, 623, 825; Guam, 427.
Potato—
Association of America, report, 332.
beetle, Colorado—
control, Wis., 653.
notes, N.Mex., 554.
summary of information, 658.
blackleg, 46; Nebr., 751.
blight, early, 46.
blight, late, 46.
blight, late, bibliographical review, 751.
blight, late, control, 247.
blight, late, notes, 44, 843.
blight, late, spray v. dust for, R.I., 544.
calico disease, transmission, Idaho, 241.
canker control, 844.
dextrose agar, H-ion concentration, 821.
diseases—
control, 46; N.J., 148.
in Alberta, 46.
in America, 751.
in Argentina, 843.
in England and Wales, 645.
in Holland, 753.
in Nebraska, Nebr., 46.
loss due to, 839.
prevention and cure, 544.
flea-beetle, control, Wis., 653.
flour, use in infant feeding, 457.
Fusarium wilt, 46.
leaf curl—
effect on yield, 443, 752.
situation in Great Britain, 752.
leaf roll in Ireland, 753.
leaf roll in Japan, 544.
leaf roll, notes, 46; Idaho, 745.
leaf roll, relation to moisture, 241.
leafhopper, control, Iowa, 757; Wis., 653.
maggot, notes, 848.
mosaic—
crop loss due to, Mich., 443.
effect on yield, 752.
elimination, Ky., 544.
in Ireland, 753.
insects as carriers, Idaho, 746.
notes, 44, 46.
relation to moisture, Idaho, 241.
situation in Great Britain, 752.
temperature relations, Wis., 643.
Rhizoctonia, control, Idaho, 746.
Rhizoctonia, notes, 46; Wash.Col., 241, 247.
rosette, notes, 843.
Potato—Continued.
rot in storage, studies, Tex., 442.
russet dwarf disease, Idaho, 745.
scab, control, Va.Truck, 348.
scab in Britain, cause, 646.
scab, notes, 843; Idaho, 746.
seedlings, comparison, Alaska, 426.
seedlings, observations, 529.
skin spot, notes, 44.
skin spot, relation to powdery scab, 47.
spindling sprout, 46.
spindling-tuber disease, 247.
tipburn and sunscald, 46.
tipburn, control, Iowa, 747.
tops, feeding value, 669.
tubers, changes in composition during growth, U.S.D.A., 247.
wart, anatomical studies, 348.
wart disease—
control, 844.
inheritance of immunity, 753.
nature of immunity from, 753.
notes, 46.
research aspects, 753.
wart—
distribution in Norway, 645.
fungus, varietal and species hosts, U.S.D.A., 443.
immune varieties, adaptability and use, U.S.D.A., 444.
immunity, stability, U.S.D.A., 444.
wilt, cause, 648.
wilt, factors affecting, Nebr., 147.
wilt, notes, 844.
wilt, studies, Oreg., 539.
witches' broom, 46.
Potatoes—
absorption of water and nitrates, 29.
Armillaria mellea affecting, 443.
as affected by—
borax, U.S.D.A., 324.
copper sprays, U.S.D.A., 247.
neutral phosphate, 517.
potash, 817.
as intercrop for apples, Mont., 136.
breeding, application of genetic principles, 133.
breeding experiments, Can., 734; Oreg., 525.
carbohydrates, effect of desiccation methods, 10.
cost of production, N.Y.Cornell, 691.
culture, Alaska, 491; Ohio, 632.
culture experiments, 34, 329; Oreg., 525, 526; U.S.D.A., 630.
culture in Australia, 229.
degeneration, 752, 822; Idaho, 751; Nebr., 752.
early, marketing, U.S.D.A., 489.
early, time of planting, 97.
effect of—
continuous culture, Nebr., 733.
preceding crop, Mont., 129; Nebr., 733; Oreg., 526.

Potatoes—Continued.
effect on following crop, 231; Mont., 129; Ohio, 329, 724.
European history, 332.
fall and winter care, Mich., 844.
fertilizer experiments, 20, 329, 825; Alaska, 426; Can., 734; Md., 333; Oreg., 525; Wash.Col., 214.
immune to wart disease, inspection and certification, 844.
irrigation experiments, 34; N.Mex., 525.
main-crop, marketing, U.S.D.A., 793.
methods of applying fertilizers, Wis., 622.
nickel and cobalt in, 520.
phloem necrosis in, occurrence and significance, 646.
potash tests with, N.H., 329.
production, papers on, U.S.D.A., 91.
production, trade, and foreign competition in, 794.
rotation experiments, Nebr., 328; Ohio, 329; Wash.Col., 214; Wyo., 429.
second generation of tubers in, 229.
seed—
certification, 332.
certification in Nebraska, 34.
degeneration, Colo., 433.
from several sources, comparison, Tex., 429.
improvement methods, 332.
northern sources, yields, La., 824.
production, U.S.D.A., 736; Wash. Col., 223.
quality, Mich., 97.
selection and care, Okla., 529.
selection experiments, Md., 332.
stock cut in storage, tests, 133.
time of selection, West.Wash., 898.
treatment, 47.
treatment, effect, Wash.Col., 247.
yield, effect of source, Tex., 429.
seeding experiments, Can., 734; Idaho, 736; Nebr., 732; Oreg., 526; U.S.D.A., 630.
spraying boom for, Wis., 653.
spraying experiments, 247; Mo., 229; N.H., 347.
sterility studies, 332.
stomatal behavior in, 422.
storage, 332.
tests, 825.
varieties, Mont., 129.
varieties, permanence of, 333.
varieties susceptible to hopperburn, Iowa, 757.
variety testing, recent aspects, 332.
variety tests, 232, 329, 825; Alaska, 426; Can., 734; Idaho, 732, 736; Oreg., 525; R.I., 526; Tex., 429; U.S.D.A., 630; Va., 134; Wyo., 429.
yield tests, field plat technique, 332.
yields, Ky., 525.
yields, factors affecting, Can., 734.

Poultry—
as required course in agricultural curriculum, 194.
atypical organisms in, R.I., 81.
breeding experiments, Guam, 471.
breeding flocks, raising males for, 576, 599.
buttermilk as source of minerals for, 674.
care in health and disease, 377.
Chantecler, developing, 171.
cold-storage holdings, U.S.D.A., 893.
color and pigmentation in, 574.
Congress, World's announcement, 200.
cost of brooding, Can., 70.
crate feeding, Can., 70.
culling, 374, 674.
culling factors, value, N.J., 576.
diseases, 178; U.S.D.A., 885.
diseases and ailments, N.C., 787.
(*See also specific diseases.*)
exhibitions, advantages, N.J., 777.
experiments, Can., 69; Idaho, 777; Iowa, 777; Okla., 470.
farm survey, 593.
fattening, 71.
feeding and marketing the broilers, Ohio, 673.
feeding experiments, 171, 172; Ind., 573; Ky., 574; N.Mex., 574; Wis., 672.
(*See also* Chicks *and* Hens, laying.)
house, colony brooder, Mo., 288
house for pullets, construction, West. Wash., 87.
houses, plans and specifications, N.J., 388.
houses; portable colony brooder, 287, 288.
inadequate rations, effect on production and hatchability of eggs, Tex., 470.
infected with *Bacillus botulinus*, remedy, Oreg., 582.
inheritance in, 674.
inheritance studies, R.I., 575.
intestinal roundworms in, West.Wash., 395.
keeping, backyard, U.S.D.A., 777.
meat production, N.J., 273.
normal temperature, 471.
parasites, nicotin for, 684.
pathological conditions peculiar to, 377.
pest, new, 848.
proteins for, 273.
raising, discussion, 373.
raising in Argentina, treatise, 171.
raising, instruction in, 96.
raising, manual, 273.
raising, returns from, Mich., 489.
research in Great Britain, 398.
septicemic disease of, 81.
sex control in, 864.
White Leghorn, inheritance of fecundity in, 273.
(*See also* Chickens, Ducks, Fowls, *etc.*)

Powell, G. H., memorial, 37.
Prairie grass, toxic limit of alkali for, 513.
Praon simulans, larval stages, 559.
Precipitation and humidity, U.S.D.A., 313.
(*See also* Rainfall.)
Precipitins, production, effect of vitamin deficiency, 279.
Pregnancy, calcium content of blood during, 765.
Preisz-Nocard bacillus in ovine pathology, 80
Pribilof Islands, biological survey of, U.S.D.A., 652.
Privet cuttings, propagation in acid medium, 836.
Prodenia littoralis, notes, 758.
Prodenia spp., control, V.I., 352.
Productivity, age of greatest, as affected by restricted diet, 766.
Project method, limitations, 492.
Project work, local leadership in, 596.
Protein—
digestibility, determination, 503.
efficiency of different livestock feeds, 369.
molecule, unidentified sulphur grouping in, 501.
requirements of calves, Pa., 274.
sources for laying hens, Idaho, 273, 777.
supplements for pigs, Pa., 271.
synthesis by Azotobacter, 626.
therapy and nonspecific resistance, 78.
value for poultry, 273.
Proteins—
amino acid determinations, 715.
and theory of colloidal behavior, treatise, 109.
animal, for growing chicks, Nebr., 777.
calculation of isoelectric point, formulas, 501.
denaturation, 502.
determination in honey, 804.
effect on development of swine, Okla., 468.
estimation of cystein in, 503.
fats, and carbohydrates, unusual proportions in diet, effect, 360.
hydrolysis, origin of human in, 11.
in diet, effect on reaction to infection with tubercle bacillus, 859.
in grains, variation as affected by respiration, 821.
in human nutrition, discussion, 762.
in oat straw, variations, 65.
isolation of tryptophan from, 714.
mixtures from corn and supplements, nutritive value, 865.
new sulphur-containing amino acid from, 714.
of barley as affected by fertilizers, 631.
of feeds, nature and value, Ill., 369.
of milk, 802.
of soy beans, Ohio, 308.
of weak and strong flours, 308.
removal from cereal extracts, technique, 110.
Proteins—Continued.
rôle in vitamin hunger, 364.
utilization in nutrition, 158.
vegetable, studies, 360.
vegetable v. animal for poultry, Can., 70.
Protozoa—
intestinal, effect of carbon tetrachlorid, 476.
of soil, methods of study, 515.
rôle in soils, 515.
with mosaic disease, Mich., 45.
Provancher, life and works, 848.
Prune diseases, parasitic, 1915–1920, 445.
Prunes, drying—
by recirculation drier, Oreg., 388.
temperature, Oreg., 507.
Pruning, experiment station research in, 106.
(*See also specific crops.*)
Prunus stocks, identification, Calif., 637.
Prunus varieties, sterility in, 222.
Pseudococcus—
calceolariae, control, La., 52.
maritimus on cedar in Florida, 354.
maritimus on roots and nodules of legumes, 655.
Pseudomonas—
citri. (*See* Citrus canker.)
citriputeale, notes, Calif., 651.
pruni, studies, 546.
radicicola. (*See* Nodule bacteria.)
Psorolyma maxilosa n.sp., notes, 550.
Psorosis, notes, Calif., 649.
Psorosis of orange trees, studies, 847.
Psylla pyri. (*See* Pear psylla.)
Psyllia mali, notes, 758.
Psyllia mali, studies, 850.
Psyllia mali, summary, 153.
Pubescence as affected by restricted diet, 459.
Public health, relation to bovine diseases, 277.
Puccinia—
antirrhini—
control, N.H., 651.
germination of teliospores, 243.
dispersa, life cycle, Ind., 538.
glumarum, life history, studies, 748.
graminis—
biologic forms, 748, 840.
resistance, mode of inheritance, 840.
spore germination, effect of acidity, 125.
tritici infection, cytological study, 45.
malvacearum, studies, 651.
spp., aecial stage, Wash.Col., 242.
spp., notes, 442.
spp., studies, Ga., 541.
triticina spores in the upper air, 747.
Pucciniastrum americanum, morphology and host relations, 846.
Pullet house, construction, West.Wash., 87.

Pullets—
characters indicative of egg production, Iowa, 777.
feeding schedule for, West.Wash., 874.
raising, West.Wash., 71.
Pulpwood production v. budworm infestation, 452.
Pulse diseases in England and Wales, 645.
Pumping for irrigation, 886.
Pumps—
air lift, construction and operation, 886.
air lift, notes, 184.
centrifugal, theory of action of impellers, 83.
Purdue University, notes, 697, 899.
Purnell bill, how to secure national interest in, 492.
Putting greens, instructions for grass planting, 635.
Pycnosoma spp., notes, 156.
Pyogenic coccus of sheep, 182.
Pyrausta nubilalis. (*See* Corn borer, European.)
Pyroderces rileyi, control V.I., 353.
Pyrolaceae, germination in, 424.
Pyrus stocks, identification, Calif., 637.
Pythiacystis citrophthora—
control, 846.
notes, 650; Calif., 649.
temperature relations of growth, 540.
Quince brown rot, notes, 442.
Quince fire blight, notes, 442.
Quinces, calyx spray, formula, Conn.State., 742.
Quinces, spray schedules for, N.J., 138.
Rabbit—
blood, nature of sugar in, 715.
brush, spring, poisonous to sheep, Nev., 582.
waltzing, 463.
Rabbits—
Angora, breeding, 374.
avenue of infection by *Bacterium abortum*, 477.
destructive to beech trees, 537.
genetic studies, 366.
glycogen and glucose in muscles, 570.
inheritance of color and pattern in, 66.
newborn, respiratory exchange in, 15.
offspring of two sires in one litter, 266.
Rabies, changes in blood and distribution of virus in animals infected with, 782.
Rabies, control, 179.
Rabies vaccine canine, single dose treatment, 478.
Radiation with mercury vapor quartz lamp, effect on rats on deficient diet, 60, 61.
Radioactivity—
of fertilizers, measuring, 217.
tests in Spain, 217.
Radish maggot, control, 557.
Radish seeds, manganese content, 731.
Radishes—
culture experiments, Alaska, 435.
fertilizer experiments, R.I., 533.
Radishes—Continued.
growth and composition as affected by length of day, 739.
surface treatment for maggots, 854.
Ragi, notes, Guam, 427.
Ragwort, notes, 179.
Rain, artificial—
apparatus, tests, 486.
on cultivated soil, 83.
Rain water, analyses, 413.
Rain water, sulphur content, 727; Ill., 315.
Rainfall—
cyclic nature, 30.
data, paradoxical, 314.
duration, intensity, and periodicity, relation, U.S.D.A., 719.
effect on borax injury, U.S.D.A., 325.
effect on organic matter in soil, Wash. Colo., 211.
effect on soil composition, Wash.Col., 211.
effect on toxicity of borax, 217.
in Nebraska, Nebr., 527.
in Saskatchewan, 894.
norms of Brazil, 615.
period, relation to sunspot period, 615.
relation to subterranean waters, 789.
(*See also* Precipitation.)
Ram, unilateral cryptorchism in, 463.
Rams, selection for studs and flocks, 168.
Rancidity, analytical detection, 410.
Ranges, carrying capacity, effect of grazing, 30.
Ranilla disease in Porto Rico, 586.
Rape as chinch bug control crop, Ill., 431.
Rape blossom beetle, control, 252.
Rape seeds, iron and manganese content, 202.
Rape, variety tests, 232.
Raspberries—
black, disease control, Mich., 846.
breeding, 236, 436.
culture, Mont., 136.
culture experiments, Alaska, 435.
fertilizer experiments, Oreg., 742.
new or noteworthy, N.Y.State, 338.
running-out of, cause, N.Y.State, 546.
variety tests, Idaho, 740; N.H., 336.
Raspberry—
anthracnose, control, Iowa, 746; Wis., 645.
buds, cause of failure, 45.
leaf curl, control, N.Y.State, 546.
leaf curl, notes, Oreg., 755.
leaf curl or yellows, control, Can., 839.
leaf rust, notes, 44.
mosaic, control, N.Y.State, 546.
mosaic, notes, Oreg., 755.
plantations, establishment and care, Oreg., 742.
root borer, notes, Oreg., 555.
rosette, control, N.Y.State, 546.
rust, notes, Oreg., 546.
sawfly, notes, Oreg., 555.
streak disease, notes, Oreg., 755.

Rats—
extermination, U.S.D.A., 351.
genetic experiments with, 366, 864.
glycogen and glucose in muscles, 570.
inheritance of size in, 864.
rate of deposition of strontium, 765.
reproductive failure on exclusive milk diet, 663.
vitamin B storage in, 665.
(*See also* Rodents.)
Reclamation—
activities of Idaho, 383.
project, Newlands, work, U.S.D.A., 696.
project, Orland, concrete lining of canals and laterals on, 685.
Service and Bureau of Soils, cooperation, 616.
Red bug, notes, Pa., 251.
Red mite, European, studies, Ohio, 352.
Red scale, control, 153.
Red spider, control, Pa., 251; V.I., 352.
Red spider, summary, Oreg., 157.
Reductase test for bacterial count of milk, 612.
Redwater. (*See* Texas fever.)
Redwood, second-growth, yield tables, Calif., 642.
Refuse, town, fertilizing value, 215.
Reindeer management, course in, 299.
Rennet in milk, effect on alcohol test, 717.
Reproduction, effect of restricted diet, 459.
Research—
agricultural. (*See* Agricultural research.)
data, source book, 392.
Resins, synthetic, and their plastics, treatise, 207.
Resistance in animals on deficient diet, serological factors, 584.
Respiration—
effect on protein percentage of grains, 821.
experiments with small animals, apparatus, 863.
in plants, studies, 728.
of submerged plants, 423.
Respiratory—
exchange of newborn, apparatus for measuring, 14.
metabolism during mental work, 560.
Rhagoletis—
pomonella. (*See* Apple maggot.)
suavis pupæ living two years, 760.
Rhinoceros beetle larvæ, green muscardine fungus on, 255.
Rhizoctonia solani, notes, 46, 839.
Rhizopus—
equinus annamensis, notes, 381.
spp., causing decay of sweet potatoes, 754.
spp., temperature relations, 540.
Rhode Island Station, notes, 198.
Rhode Island Station, report, 599.
Rhodobaenus 13-punctatus, biology, 56.
Rhododendron bug, control, 153.
Rhubarb—
culture experiments, Alaska, 435.
diseases in England and Wales, 645.
Rhynchophorus schach, summary, 855.
Rice—
and rice by-products for swine, 863.
breeding experiments, 735; Tex., 429.
brusone, notes, 844.
chlorosis, effect of nitrogenous fertilizers, 754.
culture experiments, Calif., 34; Tex., 429.
culture, tenggala system, 529.
experiments in California, U.S.D.A., 433.
experiments in Indo-China, 736.
fertilizer experiments, Guam, 427; Tex., 429; U.S.D.A., 433.
green manuring experiments, 725.
hybrids, flowering date, 734.
inheritance of characters in, 34.
irrigation experiments, U.S.D.A., 433.
lowland, natural hybrids in, 633.
nickel and cobalt in, 520.
Phosphoric acid source, from Trichinopoly phosphate, 123.
polishings, vitamin B content, 857.
production in United States, statistical study, U.S.D.A., 389.
seed bed irrigation, 633.
seed bed, temperature, 632.
seeding experiments, U.S.D.A., 433.
soils and irrigation water, Calif., 34.
soils of Ceylon, studies, 322.
stem borer, control, 556.
variety tests, Guam, 427; 429; U.S.D.A., 434.
weeds, notes, Calif., 34, 229.
weevil, parasite of, 256.
Ricin, limits of agglutination test for, 14.
Rickets—
changes in temporal bones in, 462.
etiology, 365.
experimental, present status, 263.
light waves in relation to, 65, 365.
production, acid base ratio of diet, 65.
relation of vitamin A to, Wis., 664.
symposium on, 64.
Rickets-producing effect of thyroid, 65.
Rickettsia, distribution in insect tissues, 252.
Rinderpest—
serum producing cattle, isoanaphylaxis in, 884.
studies, 179.
Road materials project, Colo., 588.
Road tests, winter, results, 887.
Roads—
administration in California, 384.
construction in Canada, 285.
impact strain gauge, 384.
secondary type, construction and maintenance, 687.
(*See also* Pavements.)
Rock for road building. (*See* Road materials.)

Rock phosphate. (*See* Phosphate.)
Rocks, sedimentary, weight per unit volume, 510.
Rodents, control in Oregon, 756.
(*See also* Mice and Rats.)
Roofing—
prepared, studies, Iowa, 788.
tiles, manufacture on the farm, 790.
Root and stem tips, excised, cultivation under sterile conditions, 627.
Root cells, size, relation to age, 424.
Root crops—
as affected by weather, 115.
breeding experiments, Can., 734.
culture experiments, Can., 734.
tests, Oreg., 525.
thinning and harvesting by machinery, 86.
variety tests, 232.
Root—
development, relation to hardpan, 30.
development, studies, 38.
diseases in England and Wales, 645.
hairs, growth period, 729.
maggots, control, 453.
nodules. (*See* Nodule production.)
rot fungus, studies, Tex., 442.
rots in soil, effect of phosphates and lime, 327.
Rose—
aphids, control by soap, N.C., 757.
aphids, pink and green, Idaho, 746.
chafer in Ontario, 848.
chafer, poisonous effect upon chickens, Conn.Storrs, 56.
cuttings, propagation in acidic media, 835.
stock diseases in England and Wales, 645.
Roselle, jellying properties, Hawaii, 411.
Rosellinia bunodes, notes, 548.
Rosellinia sp., notes, 540.
Roses—
annual, 743.
culture, Alaska, 435.
culture in America, treatise, 438.
culture in India, 835.
treatise, 438.
Rosin, production, consumption, and trade, U.S.D.A., 143.
Rotation—
experiments, Ohio, 724.
experiments in greenhouses, Oreg., 532.
experiments under irrigation, Nebr., 328; U.S.D.A., 824.
of crops, Can. 734; Ohio, 733; Oreg., 510; Tex., 429.
of crops, effect on fertility, S.Dak., 510.
of crops, value, Iowa, 723.
Roughages—
for milk production, comparison, Iowa, 578.
for steers, comparison, Iowa, 773.
Roup and chicken pox vaccine, preparation, Ky., 586.
Roup, diphtheritic, inoculation for, 885.
Roup, etiology and treatment, 482.
Roup in poultry, Okla., 586.
Rubber—
breeding experiments, 735.
brown bast—
bark and cortex in, 548.
cause and prevention, 446.
histological studies, 446.
notes, 45.
bud grafting, 143.
diseases in Ceylon, 45.
insects affecting, 152.
latex yield, 342.
plants, North American, rubber in, 29.
rôle in economic progress and international trade, 94.
rustiness in, cause, 151.
stone cell ring in bast, origin and growth, 626.
transpiration in, 626.
Rubidium in Hagerstown soil, 617; Pa., 210.
Rudbeckia, inheritance of special traits, 24.
Rural—
church survey—
homesteader and his church, 893.
of Sedgwick Co., Kans., 893.
Town and Country Series, 94, 893.
community—
activities, treatise, 391.
definition, 391.
evolution of, treatise, 391.
organization, 192, 893.
credit. (*See* Agricultural credit.)
economics in Europe, 596.
economics, investigations in, Wis., 690.
education surveys, 796.
Europe, making of, treatise, 191.
housing cooperative societies for India, 191.
industries of England, 694.
labor. (*See* Agricultural labor.)
life and education, treatise, 296.
life, improving conditions, 192.
life in Denmark, 897.
people, education of, 95.
planning, social aspects, U.S.D.A., 694.
problems in Ireland, leadership, 192.
schools. (*See* Schools, rural.)
social agencies in Ohio, 192.
(*See also* Community and Country.)
Russia, world's need of, 491.
Rust studies, Ind., 537.
(*See also special host plants.*)
Rutabagas. (*See* Swedes.)
Rutgers College, notes, 99, 197, 698.
Rye—
as affected by potash, 817.
breeding experiments, 329.
flag smut, control, 646.
grass sod, western, breaking for winter wheat, Can., 734.
grass, western, Can., 734.
grass, western, toxic limit of alkali for, 513.

Rye—Continued.
hogging down, costs and returns, Ohio, 372.
improvement, N.C., 733.
production in United States, statistical study, U.S.D.A., 389.
quality, effect of soil conditions, Mich., 419.
seeding experiments, Can., 734.
stem rust, injury from, 840.
toxic limit of alkali for, 513.
varieties, Ga., 524.
variety tests, 232; Can., 734; Idaho, 732; Okla., 428; R.I., 526.
white-ear, cause, 455.
winter, blooming and harvest time in Germany, 736.
winter, variety tests, Alaska, 426.
Saccharomyces cerevisiæ, utilization of atmospheric nitrogen by, 819.
Saccharose solution, effect on bud growth of cuttings, 834.
Saccharum species and hybrids, cytological study, 822.
Sainfoin seed, hulled and unhulled, 230.
Salix babylonica in Australia, 837.
Salmon, Pacific Coast, spoilage in, 802.
Salt consumption by cattle, Kans., 466.
Salt requirements of livestock, Wis., 167.
Salt, use against barberry, U.S.D.A., 146.
Saltpeter. (*See* Potassium nitrate.)
Salts—
alkali, toxicity and antagonism in soil, 620.
effect on soil bacteria, 321.
excess soluble, in greenhouse soils, Ind., 636.
in diet, effect on reaction to infection with tubercle bacillus, 859.
in human nutrition, discussion, 762.
in milk, effect on alcohol test, 716.
Salvia, growth and composition as affected by length of day, 739.
Samia cecropia. (*See* Cecropia moth.)
San José scale—
control, 355, 452; Mo., 253; U.S.D.A., 354; Wash.Col., 251.
summary of information, 153.
tolerance to sprays, Wash.Col., 452.
Sand blow planting, Mich., 439.
Sand measurements in making concrete, 285.
Sanninoidea exitiosa. (*See* Peach borer.)
Sap ascent, physiology of, treatise, 820.
Sap density of trees, studies, 536.
(*See also* Osmotic pressure.)
Sarcocystis tenella, morphology and development, 682.
Sarcophaga cleodis, notes, Nebr., 659.
Sarcoptes equi, morphology, 381.
Sarracenia spp., pitchers, acidity, 520.
Satsuma, culture experiments, Tex., 436.
Savage Sudan, wild tribes, big game, and bird life, treatise, 847.
Sawflies, leaf-eating, on cereals, 256.
Scabies. (*See* Mange *and* Sheep scab.)
Scale insects, control, 654.
Scalopus aquaticus machrinus, habits, 50.
Schizoneura lanigera. (*See* Apple aphis, woolly.)
Schizoparme straminea, origin of cavity in pycnidia, 349.
Schoenobius incertellus, control, 556.
School—
building, rural, improving, 95.
buildings, rural, score card for, 95.
children, energy expenditure and food requirements, 762.
of agriculture of University of Cambridge, 493.
on wheels, notes, 500.
rural consolidated, value, 393.
supervision, rural, circular letters in, 95.
Schools—
agricultural. (*See* Agricultural schools.)
consolidated and one-teacher, 896.
junior extension work in, 96.
junior high, in rural sections, 695.
professional continuation, for farm children in Belgium, 95.
rural—
elementary. State courses, 694.
health survey in Missouri, 93.
high, frame shop work for, 195.
in Wisconsin, teacher training, 96.
livestock management in connection with teaching, 395.
objectives in elementary agriculture, 597.
one-teacher, organization, 296.
recreation and play for, 96.
status of teachers in, 597.
studies in New York State, 194.
serving milk in, 277.
vocational. (*See* Vocational schools.)
Sciaridæ on indoor cucumber plants, 254.
Sclerospora spp., production and dispersal of conidia in, 46.
Sclerotinia—
carunculoides n.sp., description, 350.
cinerea pruni, notes, 248.
fructigena, notes, 44, 45.
libertiana, notes, 650, 844; Calif., 649; Mont., 148.
mespili, notes, 250.
ricini, notes, 346.
trifoliorum, notes, 44.
Sclerotiopsis concava, origin of cavity in pycnidia, 349.
Sclerotium—
rolfsii, acid requirements, Ga., 537.
rolfsii, notes, Ga., 346; N.C., 747.
sp., notes, Ky., 541.
Scours in calves, Calif., 79.
Screw worm, control, 356.
Scurvy, experimental, changes in organ weights, 162.
Scurvy, progress in thyroidectomized guinea pigs, 766.
(*See also* Vitamin C.)
Sea water, zinc and copper in, 258.

Seed—
breeding station, German-Swedish, at Darenburg, 232.
Control Service in Denmark, 232.
germination rate, relation to temperature, 522.
industry in Germany, treatise, 232.
inspection, Me., 232.
inspection work in Wisconsin, 100.
testing, methods, Mont., 831.
treatment with Uspulum, 839.
Seeding, spring, suggestions, Mich., 37.
Seed-O-San, fungicidal value, 645.
Seeds—
forest, germination studies, 141.
fumigated, hydrocyanic acid absorbed by, U.S.D.A., 456.
germination as affected by carbon bisulphid, 849.
germination, effect of alternating temperature, 221.
germination-inhibiting substances and false germination, 221.
imports, U.S.D.A., 128, 426, 523.
iron and manganese content, 202.
of Scotch pine, viability, factors affecting, 744.
oil-bearing, vitamin A content, 59.
purity and germination tests, N.J., 635.
reduction of nitrates by, 213.
sprouting, fungi on, 443.
weights of, from Indian trees, 141.
Seepage in distribution laterals, Mont., 184.
Selection—
developmental, of vascular plants, 425.
effect on Mendelian ratio, 769.
Selenium oxidation, 23.
Selenium substitution for sulphuric ion in Knop formula, 126.
Self-feeder for calves, Mont., 172.
Self-feeders for pigs, 169; Can., 68; Iowa, 572; Pa., 271.
Seminal vesicles, effect on gonad hormones on, 463.
Septicemia, hemorrhagic—
group, differentiation of organisms, 478.
immunization, Colo., 476.
in sheep, 283.
relation to sweet clover poisoning, 178.
studies, Oreg., 582.
Septoria—
apii, control, Mich., 443.
lycopersici, control, Pa., 348.
lycopersici, notes, 149.
Sereda, new genus, erection, 760.
Sericulture. (*See* Silkworms.)
Serradella brown hay, loss of nutrients in, 669.
Sesame, breeding experiments, 735.
Sewage—
Bacillus botulinus in, 860.
disposal for isolated home, Mont., 184.
disposal for rural homes, 890.
disposal systems, automatic siphon for, Ind., 596.
Sewing, energy expenditure during, 65.
Sewing for girls, 297.
Sex—
characters, effect of sight on, 164.
characters, secondary, in *Ustilago violacea*, 222.
control in Cladocera, 567.
determination in Rotifers, 567.
glands as affected by vitamin B, 562.
in farm animals, control, 864.
in young chicks, distinguishing, Conn. Storrs, 776.
linked inheritance, application, 165.
ratio as affected by restricted diet, 767.
Shaft, overhung eccentrically loaded, whirling of, 589.
Shearing machines, tests, 486.
Sheep—
barn, description, 899.
blood, nature of sugar in, 715.
blowfly in South Africa, 156.
breeding experiments, N.H., 370.
breeding for export, 168.
Bündner-Oberländer, history and characteristics, 370.
care in health and disease, 377.
cleansing of stomach worms, N.C., 787.
Corriedale, adaptability for southwestern Texas, Tex., 467.
Corsican breed, production, 168.
diseases. (*See specific diseases.*)
edible tissues, vitamin B in, U.S.D.A., 63.
effect of shearing twice a year, Tex., 467.
farming in New Zealand, 670.
feeding by method of feeding equivalents, 269.
feeding experiments, Iowa, 773.
(*See also* Ewes *and* Lambs.)
horn transmission, Idaho, 268.
managing in Union of South Africa, 168.
manure, composition, 121.
manure, fertilizing value, Ohio, 725.
number in New Zealand, 168.
parasites and diseases, U.S.D.A., 786.
parasites of, La., 283.
poisoning. (*See* Livestock poisoning, Plants, poisonous, *and specific plants.*)
pox studies, 181.
pox, vaccination against, 480.
production in Chile, 168.
raising industry in England, survey of growth, 191.
scab, control, 179.
scab, notes, 278.
thyroidectomized, calcium content of blood, 765.
(*See also* Ewes *and* Lambs.)
Shipping fever. (*See* Influenza, equine, *and* Pleuropneumonia.)
Shoe leathers, wearing qualities, U.S.D.A., 717.
Shortening action, relation to surface phenomena, 455.

Shorts, standards for, 65.
Shrubs, culture in California, 438.
Shrubs, flowering, treatise, 835.
Shrubs, ornamental, in homestead development, Ohio, 298.
Siga incertellus, control, 556.
Silage—
acids determination in, 205, 206.
apple pomace, analyses and manufacture, U.S.D.A., 675.
composition, nutritive value, and use, 166.
corn, analyses, N.H., 329.
corn, feeding value, 869; N.C., 773; Nebr., 671.
corn-soy bean, feeding value, Pa., 472.
corn, stage of maturity, studies, Pa., 284.
corn v. sunflower for beef production, Wash.Col., 268.
corn v. sunflower for milk production, Idaho, 778.
cost of cutting, Mont., 184.
crops, comparison, Can., 734.
crops, production, West.Wash., 395.
crops, seeding experiments, Can., 734.
crops, tests, Oreg., 525.
darso, feeding value, Okla., 467.
formation, losses in, 464.
losses from decomposition, Wis., 669.
making in Canada, 890.
millet, feeding value, 869.
oat and pea, feeding value, Pa., 274, 472; Wyo., 457, 867.
oat and tare, changes in, 264.
poisoning in horses, Wis., 684.
quality, factors affecting, 264.
red clover, composition and feeding value, Pa., 472.
sunflower—
and corn, experiments, U.S.D.A., 824.
effect of stage of maturity, Ill., 375.
feeding value, 869; Mont., 172; Okla., 467; Wyo., 467, 867.
for milk production, Ga., 578.
studies, Mont., 166.
v. corn, feeding value, Wis., 676.
v. corn for beef production, Wash.Col., 268.
v. corn for milk production, Idaho, 778.
sweet clover—
analyses, 771.
feeding value, 375.
microbiology, 464.
notes, 231.
oat straw, feeding value, 869.
Silicate rocks, use as potassic fertilizers, 817.
Silk, rôle in economic progress and international trade, 94.
Silkworms, diseases in India, 154.
Silkworms, toxicity of arsenic to, U.S.D.A., 449.
Silo construction in Canada, 890.
Silo erection, stave, cost accounting in, 890.
Silo walls, making impervious, Iowa, 788.
Silos, pit, semipit, and bank, construction, 792.
Silver fir tests at Avondale, 744.
Silver leaf affecting apples, 845.
Silver leaf, notes, 845.
Siphocoryne avenae, notes, Iowa, 757.
Sires—
Gold Medal, comparative talent, 677.
Gold Medal Jersey, comparison, 374.
great, effect on breeds, 878.
Hereford, classification, 865.
purebred, value on scrub and grade cows, Iowa, 779.
register of Merit Jersey, compared, 878.
(*See also* Bulls.)
Sirup, production from sweet potatoes, U.S.D.A., 506.
Sisal, breeding experiments, 735.
Sitona hispidulus, notes, Ind., 548.
Sitophilus oryza, parasite of, 256.
Skatol formation during decomposition of salmon, 802.
Skim milk—
as protein supplement for pigs, Mich., 469.
feeding value, Ky., 574; Mont., 173.
optimum quantity for calves, 676.
powdered, feeding value, 473.
sour, as source of protein for hens, Idaho, 777.
Skins and hides, disinfection, 379.
Skins, small, home tanning, U.S.D.A., 717.
(*See also* Hides.)
Skunk, nematode parasite of, 499.
Slag. (*See* Phosphatic slag.)
Slagwool, thermal conductivity, 186.
Slaughtering methods, modern, 772.
Slope exposure studies, 28.
Sludge, activated, fertilizing value, 216.
(*See also* Sewage.)
Small holdings. (*See* Land.)
Smut spore content, relation to attack in the field, 839.
Smut, stinking, control, Mich., 841.
Smuts, common, treatment, Okla., 542.
(*See also* Grain smuts, Corn smut, Wheat smut, *etc.*)
Snakeroot, white—
feeding tests, Ind., 580.
poisonous to livestock, Ind., 584.
Snapdragon—
rust, control, N.H., 351, 651.
rust, germination of teliospores, 243.
wilt, cause, 648.
Snapdragons, culture, Alaska, 435.
Snow molding, control in coniferous nursery stock, 755.
Snowdrop bulbs, weevil infesting, 357.
Snowfall of 1922–23 in United States, 207.
Soap, action on lead arsenates, 553.
Soap, use against aphids, N.C., 757.
Soapstone, use as solid lubricant, 888.
Socialism and French agriculture, 594.
Society for Horticultural Science, 104.

Society of American Florists and Ornamental Horticulturists, yearbook, 743.
Sodium—
ammonium nitrate, fertilizing value, 20, 623.
ammonium sulphate, fertilizing value, 623.
and calcium, pseudo-antagonism in dilute solutions, 730.
arsenate solution for destruction of barberry, U.S.D.A., 146.
arsenate, toxic dose for dogs, 381.
arsenite in grasshopper baits, Colo., 51.
carbonate—
formation in soils, Calif., 318.
removal from soils, Calif., 319.
toxic limit for crops, 513.
chlorid, effect on absorption by orange trees, Calif., 628.
chlorid in milk, 311.
(*See also* Salt.)
excretion as affected by potassium feeding, 464.
fluorid as poison for European earwig, 850.
hydroxid—
apparatus for dispensing, 504.
effect on grain hulls, 167.
hypochlorite, effect on foulbrood, 156; Wis., 653.
nitrate, effect on apple and pear trees, Can., 832.
nitrate, fertilizing value, 623.
silicate as wound dressing for trees, Ohio, 235.
sulphate, toxic limit for crops, 513.
Soil—
acidity—
agronomic significance, 513.
and nitrogen fixation, Kans., 414.
as affected by phosphatic slag, 21.
cause, Wis., 622.
effect on Azotobacter, 620.
effect on earthworms, 213.
measuring by alkaline liquids, 619.
nature of, 417.
relation to lime requirement, 320.
studies, 17.
tests, comparison, Wis., 623.
tests, comparison of methods, 722.
use of lime or ground chalk for, 512.
(*See also* Lime, Limestone, Liming, *and* Soils, acid.)
aeration experiment with tomatoes, 740.
air, rôle in hydrophytic habitats, 29.
analysis—
as index of soil fertility, 723.
mechanical, 210, 316.
mechanical, as affected by colloidal content, 316.
new method, 16.
of Hagerstown silty clay loam, Pa., 210.
Soil—Continued.
bacteria—
as affected by petroleum, 19.
as affected by phosphates, 21.
dissolution of organic nitrogen by, 119.
biology studies, 117.
blowing prevention experiments, N. Mex., 514.
capillarity, effect of pulverization and settlement, 512.
colloids—
absorption of plant food by, 17.
effect on mechanical analysis, 316.
treatise, 414.
composition, effect of rainfall, Wash. Col., 211.
condition—
effect on bacteria and changes in soil substance, 118, 813.
effect on flora and transformation of matter, 118.
peculiar, in San Luis Valley, Colo., 513.
differentiation, factors in, importance, 616.
drifting, control and prevention in, Saskatchewan, 894.
extracts, mannite determination in, 804.
fauna of agricultural land, 212.
fertility—
function of legumes in, Ala., 725.
index, 723.
maintenance and exhaustion, 616.
maintenance, effect of rotation, S. Dak., 510.
requirements, Iowa, 723.
studies, Miss., 414; N.C., 724; Ohio, 724; Okla., 414; Oreg., 510; R.I., 510; Wash.Col., 209; Wis., 620, 622.
treatise, 510.
gases, studies, 120.
improvement for quality of products, Mich., 419.
inoculation. (*See* Legumes, inoculation.)
investigations, neglected, 616.
management, Iowa system, Iowa, 724.
management, treatise, 510.
microorganisms, relation to crop growth, 514.
moisture—
absorption, effect of pulverization and settlement of soil, 512.
as affected by phosphates, 21.
determination, electrical method, 317.
effect of mulches, 317.
effect on seedling blight of wheat and corn, 345.
movement upon freezing, 617.
relation to sod effect on apple trees, N.Y.Cornell, 235.
studies, 211.

Soil—Continued.
moisture—continued.
studies for wheat culture, U.S.D.A., 829.
molds, growth inhibiting effect of H-ion, OH-ion, and salt concentrations, Iowa, 722.
organisms, effect of liming and manuring, Okla., 414.
particle, diameter determination, 415.
physics, studies, 210.
protozoa, methods of study, 515.
reaction, absolute, effect on Azotobacter flora and nitrogen-fixing ability, 813.
reaction, effect on growth, nodule formation, and calcium in legumes, 825.
separates, colloidal soil aggregates in, 722.
solution laws, relation to use of lime in agriculture, 518.
stimulants, experiments with, 23.
stratification and H-ion concentration in woodlands, 417.
sulphur and organic matter, correlation, Ill., 315.
survey, acidity tests as aid in, 616.
survey and field experiments, Iowa, 210.
survey in—
Ala., Houston Co., U.S.D.A., 415.
Calif., Shasta Valley area, U.S.D.A., 415.
Florida, Duval Co., U.S.D.A., 719.
Indiana, Adams Co., U.S.D.A., 511.
Iowa, Adair Co., Iowa, 810.
Iowa, Boone Co., U.S.D.A., 415.
Iowa, Cedar Co., Iowa, 811.
Iowa, Emmet Co., U.S.D.A., 719.
Iowa, Madison Co., Iowa, 810.
Iowa, Marshall Co., Iowa, 810.
Iowa, Mills Co., U.S.D.A., 315.
Kansas, Leavenworth Co., U.S.D.A., 416.
Michigan, St. Joseph Co., Mich., 16; U.S.D.A., 720.
Miss., Choctaw Co., U.S.D.A., 416.
Miss., Smith Co., U.S.D.A., 720.
Nebr., Madison Co., U.S.D.A., 416.
N.J., Bernardsville area, U.S.D.A., 720.
N. Y., Wayne Co., U.S.D.A., 721.
N.C., Guilford Co., U.S.D.A., 315.
Oreg., Josephine Co., U.S.D.A., 721.
Oreg., Multnomah Co., U.S.D.A., 316.
Texas, Erath Co., U.S.D.A., 721.
Texas, Red River Co., U.S.D.A., 416.
survey of alluvial soils in India, 416.
survey of wild land in Wisconsin, 100.
survey, papers on, 616.
temperature—
and moisture, effect on cabbage yellows, 542.
as affected by phosphates, 21.
effect of burning, 225.
Soil—Continued.
temperature—continued.
effect on pathogenicity of *Corticium vagum*, 347.
effect on seedling blight of wheat and corn, 345.
relation to disease in plants, 240.
relation to underground water, 789.
weekly average, Ky., 509.
treatment of subterranean insects, Wash.Col., 251.
type and chemical composition, relation, 616.
type, variations within, 616.
types of northern Michigan, Mich., 898.
water. (*See* Soil moisture.)
Soiling crops, feeding value, Oreg., 579.
Soils—
absorbent power for ammonia, 515.
acid, active aluminum in, 804.
acid, effect of lime on biological processes, Oreg., 514.
acid, effect on nodule bacteria, 619.
acid, of lower Seine country, 512.
(*See also* Soil acidity.)
alkali. (*See* Alkali.)
alluvial, along Ganges, nitrate in, 322.
ammonification. (*See* Ammonification.)
Bacillus botulinus in, 860, 861, 862.
Bacillus tetani in, 863.
bacterial activities as affected by salts, 321.
burned and unburned, analyses, 118.
catalytic action, 418.
classification, 616.
colloidal clay in, amount and composition, 811.
color in, relation to organic matter, Iowa, 318.
"djati" forest, of Java, 16.
dry, swelling coefficient, 317.
dry-bog, of California, 417.
effect of neutral salt solutions, 17.
fertilizer requirements, methods for determining, 815.
forest, bacteriological studies, Idaho, 213.
forest, from Czechoslovakia, biochemical studies, 511.
frozen, movement of moisture in, 617.
grassed and cultivated, carbon dioxid determination in, 120.
greenhouse, sterilization, Ind., 636.
H-ion concentration determination in, 309.
leaching of nitrates and ammonia from, 419.
lime requirements for plant production, 619.
lime requirement, relation to acidity, 320.
molkenboden, chemical studies, 811.
moor. (*See* Peat *and* Moor.)
muck. (*See* Muck soils.)

Soils—Continued.
nitrate determination in, 309.
nitrogen content. (*See* Ammonification, Nitrification, *and* Nitrogen.)
of Arkansas, analyses, Ark., 809.
of Bihar, phosphatic depletion, theory, 815.
of Blackeney Point, studies, 417.
of Ceylon, analyses, 617.
of Goa in Portuguese India, 16.
of Hagerstown, analyses, 617.
of Kansas, sulphur in, 22.
of Madison Co., Ga., analyses, 116.
of Michigan, lime requirements, Mich., 215.
of middle Niger River, analyses, 616.
of Montana, causes of infertility, Mont., 116.
of New Hampshire, lime requirements, N.H., 323.
of Pulawy, morphological studies, 116.
of Surinam, effect of tropical climate, 511.
organic, classification, Mich., 415.
organic matter in. (*See* Organic matter.)
organic phosphorus in, 815.
pasture, in Switzerland, flora and fertilizers, 511.
peat. (*See* Peat.)
phosphoric acid in, determination, 203.
phosphorus requirements, determining, 815.
productive power, determining, 120.
reaction and lime requirements, 619.
rice, of Ceylon, studies, 322.
sandy and heavy, as affected by borax, U.S.D.A., 325.
scarified, physical properties, 210.
sodium carbonate formation in, Calif., 318.
sodium carbonate removal from, Calif., 319.
sour, modification, R.I., 512.
sour, test for, 407.
sterilization—
effect on bacterial activities, 119.
in greenhouses, Ind., 540.
partial by sodium arsenate, effect, 515.
partial, significance, 515.
sterilized, bacteriological and chemical examination, Ind., 636.
studies, 210; Guam, 414; Iowa, 723; Mont., 116; Wash.Col., 209.
studies in Michigan, 616.
summer fallow experiments, Wash. Col., 209.
swelling and shrinkage, studies, 211.
tillage experiments, Wash.Col., 209.
toxic properties, 813.
treatise, 616.
water movement in, 212.
Soldering, information on, 290.
Solutions, fundamental laws, relation to use of lime in agriculture, 518.
Solutions, nutrient. (*See* Nutrient.)
Sorghum—
breeding experiments, 735; Tex., 429.
culture experiments, 329; Tex., 429.
culture in Morocco, 595.
culture under dry farming, Nebr., 527.
grain—
and fodder yields, Kans., 427.
feeding value, Okla., 464.
production in United States, statistical study, U.S.D.A., 389.
seeding experiments, U.S.D.A., 827.
variety tests, U.S.D.A., 827.
natural cross-pollination in, Tex., 429.
preparation for planting, Tex., 429.
rotation experiments, Tex., 429.
seeding experiments, Nebr., 733.
smut, treatment, Okla., 542.
smuts, control, 646.
variety tests, Fla., 824; Guam, 426; Iowa, 732; Miss., 428; Nebr., 733; Okla., 428; Tex., 429.
(*See also* Kafir, Milo, *etc.*)
Sorgo, culture experiments, Mont., 430; U.S.D.A., 630.
Sorgo, improvement, N.C., 733.
Sorgo, variety tests, Nebr., 733; U.S.D.A., 630.
Sorrel, African, source of acidity, 713.
South Carolina Station, notes, 299.
South Dakota College, notes, 198.
South Dakota Station, report, 599.
Sows, brood, mineral requirements, 871.
Sows, brood, wintering, Oreg., 572.
Sows, vaccination against abortion, Ky., 581.
(*See also* Pigs.)
Soy bean—
fungus diseases, 844.
hay, whole v. ground for lambs, Iowa, 773.
meal, feeding value, Ind., 573.
meal protein, nutritive value, 865.
meal, value in stock relations, Ind., 772.
milk, production, 230.
oil, losses in refining, 311.
sauce, manufacture, U.S.D.A., 311.
seeds, iron and manganese content, 202.
seeds, manganese content, 731.
Soy beans—
as affected by sulphur, Ohio, 625.
as chinch bug control crop, Ill., 431.
as emergency hay crop, Wis., 629.
culture, Iowa, 230; Miss., 222.
culture experiments, Mont., 430.
effect of prolonged daylight on growth and flowering, Alaska, 426.
effect on following crop, Ohio, 329, 724.
feeding value, 774; Ind., 571.
growth and composition as affected by length of day, 739.
hogging down, La., 272.
improvement, N.C., 733.
in Europe, treatise, 230.
natural cross-pollination in, 425.
nodule formation by, 35.
planted with corn, value, Iowa, 732.
productivity, relation to leaf area, 530.

Soy beans—Continued.
protein and oil content, Ohio, 308.
returns from, in Georgia, 90.
rotation experiments, Ohio, 725.
seeding experiments, Nebr., 733.
status of crop, Ohio, 333.
treatise, 35.
varieties, Iowa, 230; Wis., 629.
varieties for silage, R.I., 526.
varieties, oil and protein content, Ohio, 334.
variety tests, Guam, 427; Miss., 428; Nebr., 733; Ohio, 733; Va., 134.
variety tests for seed and hay, La., 824.
yields, La., 824; Pa., 223.
Sparganothis idaeusalis, notes, 656.
Spathodea campanulata, fungus attacking, 652.
Spermatozoa in mammals, disinfection, 683.
Spermatozoa of horse, pH value, Ky., 273.
Sphacelotheca (*Ustilago?*) *cruenta,* notes, 839.
Sphaeronema fimbriatum, notes, Miss., 441.
Sphinx moth, Achemon, in California, 154.
Spicaria javanica n.sp., description, 255.
Spiders, popular account, treatise, 256.
Spiders, red. (*See* Red spider.)
Spilographa electa, studies, N.J., 356.
Spinach—
Bacillus botulinus A in, Ill., 365.
canned, as source of botulism, 163.
downy mildew, notes, Tex., 442.
fertilizer experiments, R.I., 533.
nickel and cobalt in, 520.
varieties, R.I., 533.
Spirochetes in swine, 182.
Spodoptera mauritia, campaign against, 155.
Spondylocladium atrovirens, notes, 839.
Spongospora scurf, control, 839.
Spongospora subterranea, notes, 47.
Spores in the upper air, 747.
Sporotrichum globuliferum, notes, Nebr., 659.
Sporotrichum poae, notes, 455.
Spotted fever, Rocky Mountain, transmission by ticks, 256.
Spray—
schedule, Conn.State, 534.
schedules—
for codling moth, N.Mex., 154.
for fruits, N.J., 138.
spring and summer, West.Wash., 97.
Spraying—
and dusting equipment, treatise, 51.
and dusting, notes, 445.
dust. (*See* Dusting.)
value of spreaders in, 353.
vegetable crops, Va.Truck, 233.
(*See also* Apples, Potatoes, *etc.*)
Sprays, copper. (*See* Copper.)
Sprays, preparation and application, 540.
Sprays, spreading agents, 51.
Sprays, summer, comparison, 235.
(*See also* Insecticides, Fungicides, *and specific forms.*)
Spruce—
as nurse crop, 743.
budworm, estimate of damage by, 50.
budworm in Canada, 154.
budworm, injury in Minnesota, 254.
Douglas, value for shelter-belt, 240.
dying, in Minnesota, 254.
Sitka, properties, 790.
tests at Avondale, 744.
Squash—
bug, control, Wis., 653.
inheritance in, 822.
seed globulin, comparison with cantaloup seed globulin, 714.
self-pollination studies, 137.
summer, shape inheritance in, 629.
Squashes, culture, Mont., 136.
Stable fever. (*See* Pleuropneumonia.)
Staggers in livestock, cause, 178.
Stagonospora—
graminella, description, 445.
infossa n.sp., description, 445.
Stalk borer, notes, Iowa, 757.
Stallions, enrollment, Ind., 273.
Starch—
content, determination in presence of polysaccharids, 309.
hydrolysis by amylases, effect of organic compounds, 10.
sources, preparation, and uses, treatise, 503.
Starches, raw, digestibility, 660.
States Relations Service, editorial, 1.
Steam, effect on germs in milk cans, 277.
Steam power v. electricity for dairy operation, 84, 85.
Steers—
cost of production, Ind., 267.
dairy, raising, Ohio, 676.
dehorning and branding, chute for use in, 87.
digestion experiments, N.Mex., 868.
effect of wintering on pasture gains, 167, 867.
fasting, urinary sulphur, 370.
feeding experiments, 867, 868, 870; Ind., 267; Miss., 267, 465, 869; Ohio, 773; Pa., 268; Wis., 670.
of different ages, utilization of feed, N.Mex., 868.
roughages for, comparison, Iowa, 773.
wintering and summer fattening, N.C., 772.
yearling, pasturing, and wintering, Miss., 466.
(*See also* Cattle.)
Steganosporium argentinense n.sp., description, 445.
Stegomyia calopus. (*See Aedes calopus.*)
Stem rust, biologic forms, morphologic identity, 748.
Stenobothrus morio, control in Russia, 450.
Stenogryllus sp., notes, 550.
Stephanitis (*Leptobyrsa*) *rhododendri,* control, 153.
Stephanoderes hampei, parasites of, 255.
Stephanurus dentatus, description, 787.

Stereum purpureum, notes, 845.
Sterility—
cause in Prunaceæ, 221.
cyclic manifestation, in *Brassica* spp., 425.
defective diet as cause, 568.
in animals, Ky., 164, 273.
Sterolin, new reactions for, 410.
Sterols, new reactions for, 410.
Stigmas, sensitive, behavior, 220.
Stock. (*See* Livestock.)
Stock foods. (*See* Feeding stuffs.)
Stockyards fever. (*See* Septicemia, hemorrhagic.)
Stomach—
spontaneous ulcer of, in livestock, etiology, 679.
worms in goats, control, Tex., 481.
worms in sheep, treatment, 77; Mich., 80; N.C., 787.
Stomata, behavior of, 422.
Stomatitis of calves in Wisconsin, Wis., 681.
Stone for road building. (*See* Road materials.)
Stone screenings, use as fine aggregate for concrete, 384.
Storms, classification according to rain power, U.S.D.A., 719.
Straussia longipennis, notes, 848.
Straw analyses, as indication of potash in soil, 816.
Straw hydrolysis, 569.
Straw, hydrolyzed and untreated, composition and digestibility, 166.
Strawberries—
breeding experiments, Alaska, 435.
correlation in, 236.
culture, Mont., 136.
culture experiments, Alaska, 435.
effect of sunscald, 44.
fertilizer experiments, Oreg., 533.
insects affecting, Ark., 554.
marketing, Ky., 293.
nematode affecting, Oreg., 539.
new hybrid, Nebr., 340.
new or noteworthy, N.Y.State, 338.
nutrition as related to yield, Mo., 640.
pot-grown, fertilizer experiments, 833.
variety, notes, Oreg., 532.
variety tests, Mont., 136.
Strawberry—
hybrid, notes, 436.
leaf scorch, notes, N.C., 747.
red plant, studies, 50.
root weevil, control, mechanical devices for, 848.
rootworms, control in commercial rose houses, 658.
rot, origin of cavities in pycnidia, 349.
stem rot, notes, N.C., 747.
tiger moth, summary, Ark., 253.
weevil, summary, Ark., 554.
Streptococcus—
genitalium nocens, notes, Ky., 581.
lactis, notes, 201.
lactis, ropiness in cultures, Iowa, 376.
Streptococcus—Continued.
paracitrovorus group in dairy products, Iowa, 781.
plima, suggested name, 678.
Streptothrix israeli, notes, 380.
Striga lutea in Burma, studies, 843.
Stripe rust, life history, studies, 748.
Strongylus in horses, 77.
Strongylus paradoxus, notes, 80.
Strongylus tetracanthus, pathogenic rôle, 400.
Strontium in Hagerstown soil, 617.
Strontium in rats, rate of deposition and paths of absorption, 765.
Sucking insects, control, 152.
Sudan grass—
and soy beans as emergency hay crop, Wis., 629.
as emergency hay crop, Wis., 629.
culture experiments, Mont., 430.
fertilizer experiments, 329.
notes, Guam, 427.
pasture, value for milk production, Kans., 472.
seeding experiments, Okla., 428.
Sugar, ash determinations, 505.
Sugar beet—
agriculture in United States, 737.
nematode in Utah, dormancy period, U.S.D.A., 47.
seed testing, Mich., 35.
station, establishment, Mich., 495.
(*See also* Beet.)
Sugar beets—
as affected by neutral phosphate, 517.
cost of production in Belgium, 895.
culture, N.Mex., 525.
culture experiments, Alaska, 426.
effect of preceding crop, Mont., 129; Nebr., 733.
rotation experiments, Nebr., 328.
variety tests, Alaska, 426; Can., 734.
Sugar cane—
borer, control, La., 848.
breeding experiments, 735.
chlorosis in Egypt, 647.
crushers, animal power, tests, 586.
culture, 230, 828.
culture in Guadeloupe, 737.
depreciation, 35.
diseases in Cuba, 737.
diseases in Negros, 444.
experiments in Cuba, 737.
experiments in Hawaii, 35.
fertilizer experiments, 133, 828; La., 824.
Fiji galls, organism in, 444.
green manuring experiments, La., 824.
gumming disease, notes, 539, 550.
industry in Queensland, 828.
insects affecting, 758.
juices, phosphoric acid in, 120.
leaf spot, notes, 839.
mealybug, La., 52.
methods of testing maturity, 527.
mosaic. (*See* Sugar cane mottling disease.)

Sugar cane—Continued.
mottling disease—
cultivated and wild hosts, 647.
effect on crop, 827.
in Cuba, 737.
in Negros, 444.
mechanics of insect inoculation, 47.
notes, 539.
spread, factors affecting, 544.
transmission, 52, 550.
Olaa disease, notes, 445.
palatability of silage from, Ga., 524.
planting, new method, 334.
root borer, control, V.I., 352.
seedlings, tests, 827.
varieties, 35, 827.
varieties, new, 828.
variety tests, 133, 828; Guam, 427.
yellow stripe. (*See* Sugar cane mottling disease.)
Sugar—
content, variations in oat straw, 65.
detection in condensed waters, 408.
factor of safety, study, 614.
factory of Roye in Santerre, organization, 489.
in blood. (*See* Blood sugar.)
in urine after injection of glucose in the dog, 859.
industry of Louisiana, origin and development, 737.
industry, statistics of production and consumption, 737.
manufacture conforming to "factor of safety," 614.
maple. (*See* Maple.)
operations in India, 737.
production in French colonies, 389.
production in Mexico, 737.
raw and refined, moisture absorption, factors affecting, 613, 614.
raw, ash determination in, 408.
rôle in economic progress and international trade, 94.
Sugars—
aldose, Rosanoff's diagram, revision, 503.
reducing, determination, 310.
reducing, determination, effect of alkaline earths, 715.
reducing, electrometric titration, 203.
(*See also* Glucose, Dextrose, *etc.*)
Sulphate—
cellulose industry in Sweden, 22.
of ammonia. (*See* Ammonium sulphate.)
of potash. (*See* Potassium sulphate.)
Sulphur—
as fertilizer for cotton, 33.
as oligodynamic substance, 421.
compounds, dry, use against San José scale, 452.
compounds from decomposition of proteins, 502.
compounds, stimulating effect, 23.
Sulphur—Continued.
content of—
rain water, 413; Ill., 315.
soils and organic matter, correlation, 315.
soils, relation to plant nutrition, 420.
tomatos, 436.
effect on nitrogen loss in composts, Ga., 516.
experiments, Ohio, 625.
fertilizing value, 22; Wash.Col., 215.
flowers of, use as solid lubricant, 888.
fungicidal action, 48.
fungicides, action, N.H., 349.
in organic compounds, 203.
in plants and soils, studies, Ky., 516.
in soil, notes, 727.
inoculated, experiments with, Va. Truck, 347.
mixtures. (*See* Lime-sulphur.)
new application in plant culture, 839.
nutrient of fungi, 26.
oxidation by microorganisms, 625, 818.
oxidation studies, Oreg., 514.
spray mixtures, experiments, 235.
studies, data, Oreg., 510.
urinary, of fasting steers, 370.
value in controlling mites, 660.
Sulphur-floats-soil mixture, building up, 624.
Sulphuric acid—
concentrated, apparatus for dispensing, 504.
sprays for weed eradication, 738.
test for liver oils, 410, 611.
Sun spot period, relation to rainfall period, 615.
Sun spots, relation to temperature, U.S. D.A. 718.
Sunflower—
disease, inoculation experiments, Colo., 441.
maggot, notes, 848.
seeds, iron manganese content, 203.
silage. (*See* Silage.)
wilt, description, Mont., 148.
Sunflowers—
as chinch bug control crop, Ill., 431.
as silage crop, Wis., 630.
changes in composition, 770.
culture experiments, Can., 734.
effect on following crop, 231.
fertilizer experiments, Can., 734.
for silage, seeding, Idaho, 732.
for silage, variety tests, Can., 734.
returns from, in Georgia, 90.
seeding experiments, Can., 734; Mont., 129; Wyo., 429.
spacing experiments, Wash.Col., 223.
time of cutting tests, Can., 734.
Sunlight, effect on—
growth and composition of plants, 739.
nodule bacteria, Wash.Col., 223.
Sunshine norms of Brazil, 615.

Superphosphate—
effect on alfalfa, Mich., 431.
fertilizing value, Guam, 427; Kans., 427; Ohio, 724; Tex. 436.
production, 624.
Supra phosphate, fertilizing value, 816.
Surra transmission, 156, 157, 158.
Surveying and boundaries, laws, treatise, 483.
Surveying for settlers, handbook, 384.
Swamp fever. (*See* Anemia, infectious equine.)
Swans, North American, life histories, 756.
Swede clubroot, resistant varieties, 148, 445.
Swedes, culture, Wis., 630.
Swedes, culture experiments, Alaska, 426.
Swedes, harvesting, 86.
Swedes, variety tests, Can., 734.
Sweet clover—
as green manure, Ill., 315.
as green manure or summer pasture, Md., 334.
clipping and seed production, Ky., 525.
culture, Md., 334.
culture experiments, Tex., 429.
culture in Ontario, 230.
feeding, effect on milk, 375.
hay, tests, Idaho, 732.
Hubam and biennial, anatomy and cytology, Iowa, 731.
Hubam, behavior and adaptation, Fla., 824.
Hubam, chemical composition, Iowa, 736.
Hubam, culture experiments, Alaska, 426.
Hubam, variety tests, Iowa, 732.
nurse crops for, Can., 734.
poisoning, 178.
seed coats and delayed germination in, Iowa, 731.
seeding experiments, Idaho, 736; Okla., 428.
silage. (See Silage.)
stand and yield, factors affecting, 230.
variety tests, Can., 734; N.Mex., 525.
white and yellow, analyses at different stages, 771.
Sweet corn—
breeding experiments, Wis., 630.
canning stage, forecasting, Md., 832.
culture in high altitudes, Mont., 832.
effect of topping, Iowa, 740.
fertilizer experiments, Ohio, 337.
mulching experiments, Ohio, 337.
seed production, Ind., 531.
variety tests, 329; Mont., 136.
Sweet pea wilt, cause, 648.
Sweet peas, culture, Alaska, 435.
Sweet potato—
black rot, studies, Miss., 441.
Java black rot, cause, Tex., 442.
leaves, vitamin C in, 563.
poultice, composition, U.S.D.A., 507.
sirup, manufacture, U.S.D.A., 506.
vines, analyses, La., 272.
Sweet potato—Continued.
vines, palatability of silage from, Ga., 524.
weevil, control, La., 855.
Sweet potatoes—
breeding experiments, 735.
feeding value, 470.
fertilizer experiments, Ga., 524; Md., 333; Miss., 222.
hogging down, La., 272.
soft rots, 754.
spacing experiments, Miss., 222.
variety tests, Guam, 427; Miss., 222, 428.
Swine—
common animal parasites, Ill., 481.
diseases and ailments, U.S.D.A., 787.
erysipelas bacillus in poultry, 81.
erysipelas immunization of horses, reactions, 482.
(*See also* Pigs.)
Sylvinite and components, comparison, 817.
Symbiosis in a deciduous forest, 523.
Symbiosis in plants, 819.
Symptomatic anthrax. (*See* Blackleg.)
Synchytrium endobioticum—
distribution in Norway, 645.
varietal and species hosts, U.S.D.A., 443.
Synchytrium sp., notes, 839.
Syrphidae, biological and taxonomic studies, relation, 848.
Tabanidae in Louisiana, 657.
Tabanus—
albimedius, transmitting surra, 157.
nemocallosus, transmitting surra, 156.
pumilus, notes, 657.
spp., transmitting anthrax, La., 881.
spp., transmitting surra, 158.
Table service and etiquette, Ark., 897.
Tachinid infestation, resistance to, 255.
Taenia crassicollis, biology of, 76.
Talc, use as solid lubricant, 888.
Tamarack swamp, first breaking experiments, 686.
Tañgantañgan, feeding value, Guam, 464.
Tankage—
as protein supplement for pigs, Mich., 469.
as substitute for beef scrap, Can., 70.
digester, low quality of, Ind., 772.
feeding value, Idaho, 774; Ind., 571; N.C., 775; Tex., 469.
fertilizing value, 834.
minerals and possible substitutes for, Ohio, 371.
v. cottonseed meal for laying hens, Tex., 470.
Taphrina bussei, notes, 540.
Taphrocerus gracilis, life history, N.Y.Cornell, 854.
Tapioca making, 56.
Taro, culture experiments, Guam, 427.
Taro, variety tests, Guam, 427.
Tartaric acid—
determination in fruit juices, 805.
value for jelly making, Del., 9.

Taxonomy experiments, 29.
Tea, breeding experiments, 735.
Tea crop, optimum weather conditions, 15.
Tea leaf skeletonizer, 453.
Tea red rust, 45.
Tea, termites affecting, 450, 849.
Technical education, cost, 596.
Temperature—
alternating, effect on germination, 221.
and fat percentage in milk, relation, 73.
belts and fruit growing in North Carolina, U.S.D.A., 314, 337.
changes, relation to subterranean water, 789.
effect on—
color of hair and feathers, 165.
nitrogen fixation, 18.
ommatidial number in heterozygous fruit fly, 266.
Ustillago zeas, 749.
norms of Brazil, 615.
observations, relation to codling moth control, U.S.D.A., 509.
of adult fowls, studies, N.C., 787.
of fermentation, effect on silage, 264.
optimum, for rice seed beds, 632.
relation to seed production in Scotch pine forests, 744.
relation to sun spots, U.S.D.A., 718.
(*See also* Climate *and* Soil Temperature.)
Tenebrio molitor, parasite of, 157.
Tennessee Station, notes, 498, 900.
Tennessee University, notes, 498, 900.
Termites affecting tea, 450, 849.
Termites in savage Sudan, 847.
Testicles, function, effect of sight on, 164.
Tetanus, popular account, 379.
Tetranychus telarius, control, V.I., 352.
Tetrastichus diarthronomyiae, notes, 56.
Texas fever immunes, hypertrophy of hemolymph nodes in, 681.
Texas fever in cattle, Wash.Col., 278.
Texas fever ticks. (*See* Cattle ticks.)
Texas Station, notes, 99, 498.
Texas Station, report, 495.
Textile industry, dictionary of terms, 528.
Thanet weed, eradication, 831.
Theileria mutans of Mediterranean Basin, 400.
Therion morio, notes, 555.
Thielavia basicola, notes, Fla., 838; Ga., 537; Ky., 544.
Thielavia basicola on Lupinus, 843.
Thingan timber, properties and uses, 43.
Thiobacillus thiooxidans, use as sulphur-oxidizing agent, 818.
Thiosulphate, use, effect of pH value, 26.
Thomas slag. (*See* Phosphatic slag.)
Thresher cylinder, mechanics of, 86.
Threshing drums, balancing, 485.
Thrips tabaci. (*See* Onion thrips.)
Thyroid, rickets-producing effect, 65.
Thyroidectomized animals, calcium in blood of, 765.
Tick fever. (See Piroplasmosis *and* Texas fever.)
Ticks in Punjab, 157.
Ticks of Panama, hosts in relation to disease transmission, 157.
Ticks, transmission of Rocky Mountain spotted fever by, 256.
Ticks, transmission of surra by, 157.
(*See also* Cattle tick.)
Tiles, roofing, home manufacture, 790.
Tillage experiments, Nebr., 732.
Tillage studies, Oreg., 526.
Tilletia tritici, control, 841.
Timber—
coniferous, bluing in, 447.
estimating, instructions, 837.
insects affecting, 84.
mine or crop, U.S.D.A., 341.
preservative treatment, Mont., 184.
standing, binocular attachment for observations on, 50.
strength obliquely to the grain, formula, 687.
(*See also* Lumber *and* Wood.)
Timbers—
Indian, air-seasoning, 84.
Mysore, mechanical tests, 687.
of Nigeria, identification, guide, 42.
Timothy—
culture experiments, 735; Mont., 430.
effects of self-fertilization in, 134.
exudate water from, solids in, N.Y. Cornell, 520.
hay, feeding value, Mont., 172.
hay, methods of handling, Colo., 86.
improvement work, N.H., 328.
life history, 528.
seed production trials, Can., 734.
seeding experiments, Can., 734; Idaho, 736.
toxic limit of alkali for, 513.
Tires, pneumatic and solid, specifications, 185.
Titanium content of kaolin and clay, 414.
Titration, electrometric, for determination of reducing sugars, 203.
Titration of acids and bases, antimony electrode for, 803.
Tobacco—
angular leaf spot, control, 545.
auction system and cooperation, 231.
bacterial leaf spot, 248.
black shank, notes, Fla., 838.
blackfire, description and control, 647.
color and quality as affected by time of harvesting, Conn.State, 634.
culture and preparation, handbook, 36.
culture for nicotin, 36.
culture, history, U.S.D.A., 334.
culture in Ilorin Province, 734.
curing, Angeloni system, 36.
curing barn, description, 899.
curing experiments, Conn.State, 633.
dark, experiments, Va., 134.
diseases in England and Wales, 645.
dust, aphiscidal properties, N.Y.State, 552.

Tobacco—Continued.
dust lime mixture, insecticidal value, N.H., 351.
effect of prolonged daylight on growth and flowering, Alaska, 426.
effect on arsenical compounds, 751.
experiments in Pennsylvania, Pa., 737.
fermentation experiments, Conn.State, 634.
fertilizer experiments, 734; Ky., 524; N.C., 733.
foot rot, notes, Fla., 838.
fumigation, open air, 758.
insects affecting, in Porto Rico, 53.
leaf-folder on tomatoes, 759.
leaf spot, notes, Fla., 838.
machines for cleaning seed, smoking, and drying, Pa., 737.
mosaic, control, 148.
mosaic, infectious agent in cells, 148.
mosaic studies, Ky., 545.
nicotin determination in, 807.
production in Southern States, 231.
returns from, in Georgia, 90.
root knot, notes, Fla., 838.
root rot, notes, Fla., 838.
root rot, resistant strains, Ga., 537.
root rot, resistant varieties, Ky., 544.
rotation experiments, Ky., 524.
seeds, iron and manganese content, 202.
stem rot, notes, N.C., 747.
textbook, 36.
variation in nicotin content, Ky., 524.
variety tests, Alaska, 426; Guam, 427; Va., 134.
wildfire—
control, 48, 545; Conn.State, 647.
description and control, 647.
in Wisconsin, Wis., 643.
notes, 300; Fla., 838.
studies, Conn.State, 647.
Tomato—
bacterial spot, control, Ind., 538.
blight, late, notes, 149.
blight, western yellow, Wash.Col., 242.
buckeye rot, notes, 44.
diseases, 45, 149.
leaf spot, control, Pa., 348.
mosaic, overwintering, Ind., 538.
pulp, vitamin A in, 769.
seed press cake protein, value, 865.
sleepy disease, notes, 647.
watery rot, notes, 844.
weevil, Australian, control, 761.
wilt, location of organism, Tex., 442.
wilt, studies, Miss., 441.
Tomatoes—
as a truck crop, U.S.D.A., 833.
as affected by phosphorus, N.H., 336.
blossom drop and yield, 138.
dusting experiments, Va.Truck, 233.
effect of phosphatic fertilizers, 726.
effect of phosphoric acid on, 234.
fertilizer experiments, 741; Miss., 234; Ohio, 337; Tex., 436.
growth and composition as affected by length of day, 739.
Tomatoes—Continued.
home-grown strains, Mont., 136.
irrigation experiments, 138.
mulching experiments, 740; Ohio, 337.
new varieties, distribution, Pa., 232.
nickel and cobalt in, 520.
pickled, spot of, notes, 545.
pollination experiments, Oreg., 532.
selection experiments, Guam, 435; Idaho, 740; Ill., 336; Ind., 531.
sulphur content, 436.
tobacco leaf-folder affecting, 759.
varieties, U.S.D.A., 636.
variety tests, Tex., 436.
vitamin C in, destruction by heat, 563.
yield and quality, Miss., 234.
Tortrix fumiferana in Minnesota, 254.
Torula heveanensis, notes, 151.
Torula (Trachytora) asperrima n.sp., description, 445.
Town and farmer, relations, Wis., 690.
Tractor—
engines, air cleaners for, tests, 688; Calif., 688.
hitches, side draft studies, Calif., 287.
tests on palm oil, 590.
wheels, open or latticed, Mich., 85.
Tractors—
automatic uncoupling apparatus, 85.
general purpose, history and development, 889.
in Arkansas, Ark., 590.
in Montana, Mont., 485.
tests in Nebraska, analysis, 791.
types for use in India, 688.
uses of ball and roller bearings, 589.
Trail construction in national forests, U.S.D.A., 790.
Trametes—
persoonii, notes, 540.
pini on Douglas fir, U.S.D.A., 755.
radiciperda, soil conditions affecting, 447.
Transpiration—
and wilting in plants, 521.
in *Hevea brasiliensis*, 626.
physics of, 127.
Tree borers, control, Oreg., 357.
Tree crickets, notes, Oreg., 555.
Tree seeds, effect of soaking on viability and germination, 440.
Tree twigs, growth, 128.
Trees—
and shrubs of Mexico, 837.
annual rings, climatic cycles from, 30.
broad-leaved, behavior at Avondale, 744.
coniferous. (*See* Coniferous.)
culture in California, 438.
economic, of China, 745.
forest, description, 837.
identification, pocket guide, 836.
northern broadleaf, culture in Australasia and South Africa, 837.
northern, in southern lands, 836.
of India, classification, 143.
of India, weights of seeds, 141.

Trees—Continued.
of Virginia, characteristics, 239.
ornamental, in homestead development, Ohio, 298.
ornamental, varieties, U.S.D.A., 636.
Philippine dipterocarps, anatomical features and properties, 143.
planting in Great Plains, U.S.D.A., 141.
Rocky Mountain, physiological requirements, 535.
shade, care of, handbook, 439.
shade, insect enemies, control, 51.
shelter-belt, planting, Mont., 137.
shelter-belt, tests, 240.
tall, dusting by airplane, 654.
wilting coefficient tests, 536.
wound dressing, new, Ohio, 235.
young, pruning experiments, N.H., 336.
Trembles. (*See* Milk sickness.)
Trichomonas hominis, notes, 477.
Trichostrongyles, control, 77.
Trichuris, treatment for, 788.
Tricolyga bomycis, notes, 154.
Trioza tripunctata, life history and habits, N.J., 353.
Triticum spp., cross between, 36.
Truck crop diseases, studies, Ind., 537.
Truck crops—
insects affecting, V.I., 654.
returns from, in Georgia, 90.
Trucks. (*See* Motor trucks.)
True, A. C., biographical sketch, 2.
True, A. C., tribute of appreciation, 706.
Trypanosoma—
cruzi in tissues of armadillo, 180.
equiperdum, arsenic-fastness, effect on treatment with arsphenamin, 479.
equiperdum, effect of Bayer 205 on, 680.
equiperdum rendered uninfective, 683.
marocanum, notes, 400.
melophagium, notes, 182.
Trypanosomiasis in British sheep, 182.
Trypanosomiasis, treatment, 400.
Tryptophan, content of milk serum, 802.
Tryptophan, new reaction, 110.
Tryptophan, preparation, 714.
Tryptophan, requirement of rats, 158.
Tubatoxin, insecticidal value, 152.
Tubercle bacilli, human and bovine, 380.
Tuberculin test, in cattle, 783.
Tuberculin test, value in maintaining a tubercular-free herd, N.Y.State, 380.
Tuberculization, double local reaction, 78.
Tuberculosis—
avian, and its bacillus, 180.
biochemistry and chemotherapy, 379.
bovine, in Hawaii, 378.
bovine, nonspecificity of complement fixation test for, 78.
complement fixation test in, 883.
diagnosis, fixation reaction in, 78.
diagnosis, new serum reaction, 680.
eradication work, 178.
experimental, in rats on varied diets, 859.
Tuberculosis—Continued.
experimental, nutrition in, 479.
immunotherapy and chemotherapy in, new attempts, 783.
in cattle, serum diagnosis, 180.
in children, types of organism, 479.
in livestock in United States, 282.
nonspecific cutaneous reactions in, 282.
notes, 278.
relation of heredity to, 567.
Tularaemia Francis, a new disease of man, 455.
Tularæmia in Washington, D.C., market, 784.
Tumor-like plant formations, 820.
Tumors and heredity, 279.
Tuna fish meal, production, 122.
Turf-dike fencing, 586.
Turkeys, raising in Argentina, 171.
Turnip aphids, control, N.C., 757; Wis., 653.
Turnip finger-and-toe disease, relation to pH of soil, 845.
Turnips—
culture experiments, Alaska, 426.
surface treatment for maggots, N.H., 854.
thinning and harvesting, 86.
Turpentine, production, consumption, and trade, U.S.D.A., 143.
Turpentining operations, effects, 238.
Twins, genesis, new data, 567.
Tylenchulus semipenetrans, studies, Calif., 350.
Tylenchus devastatrix, notes, 839.
Tylenchus tritici, notes, N.C., 747.
Typhlocyba comes. (*See* Grape leafhopper.)
Typhoid bacteria, duration of life in septic tank, 591.
Typhoid fly. (*See* House fly.)
Tyramin, action on pigeon beriberi, 462.
Tyroglyphus mycophagus, biology and control, 157.
Udder, surgical diseases of, 178.
Ulcers in stomach of domestic animals, etiology, 679.
Ultraviolet light radiation, effect on growth of rats on deficient diet, 60, 61.
Undernutrition—
chronic, ammonia excretion in, 159.
qualitative, studies, 562.
(*See also* Diet, deficient.)
United Farmers of Ontario, organization and development, 295.
United States Department of Agriculture—
annual reports, 395.
Bureau of Home Economics. (*See* Bureau of Home Economics.)
Bureau of Soils. (*See* Bureau of Soils.)
graduate work in, 491.
notes, 200, 499.
organization list in agricultural colleges and experiment stations, 492.
States Relations Service. (*See* States Relations Service.)

United States Department of Agriculture—Continued.
Weather Bureau. (*See* Weather Bureau.)
yearbook, 395.
Uranium, effect on growth of Aspergillus, 27.
Urea determination in milk, 205.
Urea determination in urine, 205, 806.
Urea, fertilizing value, 20, 623.
Urea, manufactured from ammonia, 517.
Urea, nitrate, fertilizing value, 20, 623.
Urea, nitrogen content, determining, 717.
Uredinales of Indiana, 145.
Uredineae, teleutospores, germination, conditions, 145.
Uric acid—
determination, effect of exposure to light, 113.
excretion, effect of organic acids, 858.
excretion on purin-low diet, 458.
metabolism, studies, 662.
Urine—
ammonia and urea determination in, 806.
composition of growing dogs, 764.
constituents, variations in, 560.
nitrogen determination in, 111.
nitrogen distribution in, 257.
of Chinese in Peking, composition, 660.
sugar in, after glucose injection, 859.
urea determination in, 205, 806.
vitamins in, 260.
(*See also* Manure, liquid.)
Urocystis occulta, notes, 840.
Urocystis tritici, life history and control, Ill., 343.
Uromyces appendiculatus, notes, 841.
Uromyces spp. on Euphorbia seed, 442.
Urophlyctis alfalfae, biology, 146.
Uspulun—
seed treatment with, 839, 841, 842.
treatment of barley, tests, 840.
Ustilaginales of Indiana, 145.
Ustilago—
avenae, effects of soil factors, 749.
avenae, spore germination, 749.
levis, control, Wash.Col., 241.
paradoxa, notes, 839.
violacea conjugation and secondary sex characters, 222.
zeae, spore germination as affected by temperature, 749.
Ustulina zonata, notes, 45.
Utah College, notes, 198.
Utah Station, notes, 198.
Vaccine and serum therapy in veterinary practice, treatise, 78.
Vaccine studies, 378.
Vanadium in Hagerstown soil, 617; Pa., 210.
Variation—
law of homologous series in, 822.
nontransmissible tricolor, in rats, 368.
(*See also* Mutation *and* Heredity.)
Variegation in cultivated plants, 128.
Varnishes, tests, 385.
Vegetable—
diseases in England and Wales, 645.
diseases, studies, Ind., 537.
fats. (*See* Fats.)
galls, character and origin, 45.
gardening. (*See* Gardening.)
oils. (*See* Oils, vegetable.)
saps, physico-chemical properties, 24.
Vegetables—
Bacillus botulinus in, 860, 861, 862.
Bacillus tetani on, 863.
biennial, for seed production, wintering, Idaho, 740.
canned, spoilage in, Colo., 412.
culture, Can., 832.
culture, handbook, 832.
dependable varieties, Ohio, 234.
fumigated, hydrocyanic acid absorbed by U.S.D.A., 456.
importance as food, 364.
oriental, antiscorbutic vitamin in, 563.
production and trade, 376.
Vegetation—
at Northern Great Plains Station, effect of grazing, U.S.D.A., 865.
broad-sclerophyll, of California, 822.
in pastures, effect of burning, 224.
Velvet bean meal, effect on butter fat, Fla., 875.
Velvet beans—
feeding value, Miss., 465.
Georgia, nutritive value, 668.
seeding experiments, La., 824.
v. cottonseed meal, Miss., 471.
variety tests, Guam, 426; La., 824.
Ventilation, treatise, 591.
Vermicularia zingibereae, suggested name, 147.
Veronica cuttings, propagation in acid medium, 836.
Verticillium alboatrum, notes, 839.
Verticillium alboatrum, studies, 647.
Vetch—
as affected by inoculation, Ariz., 620.
as cover crop, Oreg., 534.
behavior and adaptation, Fla., 824.
breeding experiments, Oreg., 525.
culture experiments, Alaska, 426; Mont., 430; Oreg., 525.
effect on following crop, Oreg., 526.
Hungarian, culture in Oregon, 530.
Hungarian, summary, U.S.D.A., 828.
narrow leaf, value, N.C., 733.
place in fall cropping, West.Wash., 898.
seeding experiments, Oreg., 525; U.S.D.A., 828.
toxic limit of alkali for, 513.
variety tests, Oreg., 525.
Veterinary—
hygiene, treatise, 278.
practice, vaccine and serum therapy in, 78.
(*See also* Animal diseases.)
Village life in England, 694.

Vinegar, pear, preparation, Calif., 206.
Vines, culture in California, 438.
Vineyards, frost protection by artificial clouds, 615.
(*See also* Grapes.)
Violet soft rot, cause, 651.
Virginia College, notes, 900.
Virginia Station, notes, 300, 900.
Virginia Truck Station, notes, 199.
Viscometer, description, 110.
Vitamin—
A administered parenterally, action, 666.
A and action of light, relation, 60, 61.
A association with lipochromes of plant tissues, 768.
A content of milk, increasing, 780.
A deficiency of mangels, 263.
A deficient diet, effect on blood platelets, 61, 562.
A distribution in whole milk and skim milk, Wis., 664.
A formation in plant tissues, 767.
A in lard from hogs on control ration, 59.
A in rat liver, storage, 260.
A in vegetable oils and fats, 59.
A potency in cod-liver oils, 461.
A relation to rickets, Wis., 664.
A requirement of growing chicks, 673.
A requirement of pigs, Ill., 369.
antineuritic, in urine, 260.
B administered parenterally, action on growth 666.
B and yeast vitamin bios, relation, 856.
B, concentrating from wheat bran, 160.
B content of yeast, 562.
B deficiency, effect on metabolism, 857.
B deficiency, effect on sex glands, 562.
B detection, 562.
B determinations, use of rats for, 665.
B effect on growth of organs in cockerels, 569.
B for rats, daily requirement, 62.
B from Azotobacter, 365.
B in edible animal tissues, U.S.D.A., 63.
B in eggs, 161.
B in milk, as affected by ration of cow, Wis., 666.
B in rice polishings, 857.
B, significance in carbohydrate metabolism, 359.
B storage by rats, 665.
B yeast methods for determining, 857.
C chemistry of, Wis., 610.
C destruction of heat, 563.
C detecting, 805.
C in fats, investigations, 58.
C in goat's milk, Ohio, 259.
C in lemon juice, effect of reaction on oxidation, 806.
C in oriental fruits and vegetables, 563.
C in sterilized lemon juice, 365.
Vitamin—Continued.
C in urine, 260.
C introduced parenterally, passage into milk, 666.
C introduced parenterally, utilization by organism, 666.
C preparations, concentrated, conservation of potency, 806.
C relation to bacterial infection, 461.
C requirements of growing chicks, 673.
content of milk—
as affected by formaldehyde, 459.
papers on, 176.
variation, Ohio, 376.
D, designation, Ohio, 259.
D, studies, 261.
deficiency, effect on—
blood, 565.
digestive enzyms, 161.
oxygen consumption, 767.
preparations, tests, 259.
requirements of fish, 565.
Vitamins—
and iron metabolism, 564.
effect on calcium metabolism, 58.
function in metabolism, 364.
health, and daily diet, Ark., 364.
immunologic significance, 279.
importance in livestock feeding, 256.
importance in pig feeding, 672.
in human nutrition, discussion, 762.
in ice cream, 59.
in infant feeding, 856.
in the food supply, 364.
nature and function, 663.
relation to health and disease, 159.
rôle in assimilation of food, 159.
rôle in bacterial growth, 460.
rôle in iron assimilation, 564.
rôle in tropical diseases, 160.
sources and function, Ohio, 259.
studies, 64.
Vocational—
education in China, 796.
(*See also* Agricultural education, vocational.)
Rehabilitation Act, administration, 194.
Volcanic ash, fertilizing value, 23.
Voluntary muscle, vitamin B in, U.S.D.A., 63.
Volutin in *Azotobacter chroococcum*, 731.
Wall boards, heat transmission, Colo., 87.
Walnut—
gloeosporium disease, 847.
hull maggot pupæ living two years, 760.
leaf blight, notes, N.C., 747.
Walnuts—
culture experiments, N.Mex., 532.
fertilizer experiments, 438.
War and agriculture, 595.
Washington College, notes, 199.
Washington College Station, report, 298.
Washington Station, notes, 199.

Water—
autopurification in reservoirs, 586.
bacteriological content as affected by metallic salts, 285.
bacteriological examination, Mich., 483.
buffalo as dairy animals, 72.
condensed, detection of sugar in, 408.
duty of. (*See* Irrigation water.)
flow, calculating pipe sizes, 685.
glass as wound dressing for trees, Ohio, 235.
ground, laws of movement and determination of quantity, 82.
hemlock, poisonous to livestock, Ind., 584.
in atmosphere, 15.
in soil, storage and recovery, U.S.D.A., 418.
measurement devices for irrigation canals, 886.
movement in loam soils, 212.
pipes, friction heads, calculating, 284.
power development in Wyoming, 483.
purification, progress, 285.
rain. (*See* Rain.)
resources and geology of Sacramento Valley, 587.
seepage, return to lower South Platte River, Colo., 82.
storage, studies, Mont., 184.
subterranean, and meteorologic agents, 789.
supplies, public, industrial utility, 587.
supply of—
Colorado River Basin, 184.
Great Basin, 184.
Hawaii, 789.
Idaho, 383.
North Atlantic drainage basins, 685.
St. Lawrence River Basin, 383.
United States, 788.
Wyoming, utilization, 587.
systems, size of pipes for, 483.
tanks, masonry, constructed on silos, Iowa, 788.
use by wheat on Great Plains, U.S.D.A., 134.
waste, from gas works, 216.
Waterfowl, migrations, U.S.D.A., 351.
Watermelon blossom-end rot, cause, Tex., 442.
Watermelon downy mildew, notes, N.C., 747.
Waterproofing materials for concrete., 286.
Waterproofing materials, tests, 386.
Water-soluble B. (*See* Vitamin B.)
Water-soluble C. (*See* Vitamin C.)
Wax moth caterpillar, epidemic, 155.
Waxes, analysis, treatise, 608.
Wealth accumulation by farmers, 290.
Weather—
and climate of Vermont, 208.
and the crop yield in Scotland, 115.
Bureau, historical account, U.S.D.A., 718.
Weather—Continued.
Bureau report, U.S.D.A., 508.
conditions, optimum for tea crop, 15.
damage to cotton, U.S.D.A., 33.
of Scotland in 1922, 615.
weekly notes, U.S.D.A., 90, 294, 390, 594, 693, 793, 892.
(*See also* Meteorological observations *and* Meteorology.)
Webworm, fall, natural control, 555.
Webworm, silver-striped, studies, 655.
Webworm, striped sod, summary, 656.
Weed pests, notes, 599.
Weed survey of Ontario, 825.
Weeds—
control, in rice fields, U.S.D.A., 434.
control methods, Wis., 630.
control through spraying, 738.
eradication, cooperative experiments, 825.
infesting rice fields, Calif., 229.
self-sowing, distribution in Russia, 37.
Weevils, important, in Porto Rico, 56.
Weevils in stored grain, destruction, 455.
Weirs, adjustable proportional, drawings, 886.
Weirs, construction, 789.
West-Indian College of Tropical Agriculture, 95.
West Virginia Station, notes, 199.
West Virginia University, notes, 199.
Western Washington Station, bimonthly bulletin, 97, 395, 599, 898.
Wheat—
and flax as combination crops, Minn., 431.
and flour, correlation, 231.
as affected by potash, 817.
as hog feed, Mich., 898.
Banat, description, 335.
black rust in western Europe, control, U.S.D.A., 146.
bran, vitamin B concentration from, 160.
breeding experiments, 36, 329; Idaho, 732; S.Dak., 527; Tex., 429; U.S.D.A., 825.
bunt. (*See* Wheat smut, stinking.)
classification, U.S.D.A., 825.
club, description, U.S.D.A., 335.
commercial classes, milling and baking qualities, 830.
cost of production, Ind., 592; N.Y.Cornell, 691; Wash.Col., 291.
cost of production in Belgium, 895.
cross, inheritance of growth habit and stem rust resistance, 750.
culture, Alaska, 491.
culture, continuous, Okla., 428.
culture, continuous with and without manure, Okla., 434.
culture experiments, 329; Can., 734; Tex., 429; U.S.D.A., 630.
(*See also* Wheat, spring, and Wheat, winter.)
culture in Morocco, 595.
deformation, cause, 246.

Wheat—Continued.
development, changes during, 830.
development, photoperiodism in, Wash. Col., 223.
disease, premature ripening, Ky., 541.
durum, selection, 736.
durum, varieties, U.S.D.A., 37.
effect of tillage methods, U.S.D.A., 828.
effect of preceding crop, Ohio, 329, 724.
effect of straw mulch, Ohio, 329.
effect on following crop, Mont., 129.
farm storage of, Kans., 489.
fertilizer experiments, 20, 31, 329, 825; Ga., 524; Kans., 427; Ohio, 738.
flag smut—
description, U.S.D.A., 841.
resistance, Ill., 343.
varietal resistance, Ill., 343, 541.
flour. (*See* Flour.)
foot rot, notes, 45, 541, Kans., 443; Wash.Col., 241.
foot rot, studies, Oreg., 538.
fumigated, hydrocyanic acid absorption and retention, U.S.D.A., 456.
green v. rotted manure for, Can., 734.
hard, of Morocco, 736.
hay yields, Mont., 430.
Helminthosporium foot rot, 244.
hybrids, chromosome number variations, 25.
improvement, N.C., 733.
infection by stinking smut, effect of moisture, Idaho, 745.
joint rot, notes, 541.
leaf rust, studies, Ga., 541.
manuring experiments, Can., 734.
Michikoff, description, Ind., 830.
middlings as protein supplement for pigs, Mich., 469.
milling and baking tests, U.S.D.A., 825.
natural crosses in, 36.
nematode, notes, N.C., 747.
new, for areas of limited rainfall, 100.
nickel and cobalt in, 520.
nitrogen content, factors affecting, 830.
of Bihar and Orissa, classification, 231.
packing experiments, U.S.D.A., 829.
position in American agriculture, U.S.D.A., 389.
prices, forecasting, 594.
prices in Chicago for 81 years, 693.
production—
intensive, in Tunis, 736.
labor requirement, 189.
on dry lands, U.S.D.A., 828.
trade, and foreign competition, 794.
protein composition, factors affecting, 821.
purchasing power, Nebr., 292.
quality, effect of soil conditions, Mich., 419.
resistance to Hessian fly, 657.
rôle in economic progress and international trade, 94.
Wheat—Continued.
root system, development, 521.
rosette disease, control, 343.
rosette studies, Ind., 538.
rosette symptoms compared to diseases caused by insects, U.S.D.A., 344.
rotation experiments, Ohio, 725; Oreg., 526.
rust control, Mont., 146.
rust resistance in crosses, 841.
rust resistant strains, Ind., 538.
scab, conditions of growth, Wis., 644.
seed color and rust resistance, 840.
seeded on corn, effect of residual manure, Mont., 130.
seeding experiments, Can., 734; U.S.D.A., 828.
seedling blight, factors affecting, 345.
seedlings, effect on pH of nutrient solutions, 627.
seeds, iron and manganese in, 202.
situation in Northern Great Plains, 596.
smut—
control, Idaho, 746; Oreg., 538; Wash.Col., 241, 245.
increase of resistance to, 45.
infection, relation to moisture, Idaho, 241.
resistant varieties, Wash.Col., 223.
spore content, estimation, 841.
stinking, control, 645, 841.
stinking, effect of soil moisture, Idaho, 745.
stinking, resistance, genetics, 244.
treatment, Okla., 542.
(*See also* Smuts *and* Grain smut.)
soil and climate needs, Ohio, 737.
spring—
breeding experiments, Oreg., 525.
culture experiments, Oreg., 525; S.Dak., 635.
effect of preceding crop, 231; Nebr., 527.
plowing dates, U.S.D.A., 829.
rotation experiments, Oreg., 526.
use of stored water in soil, U.S.D.A., 418.
use of water on Great Plains, U.S.D.A., 134.
varieties, Wis., 629.
variety tests, 232; Alaska, 426; Can., 734; Idaho, 732; Mont., 129, 130; N.Mex., 525; Oreg., 525; S.Dak., 635; Wash.Col., 224.
yields, Mont., 130; Ohio, 733; Pa., 223.
stem maggot, studies, S.Dak., 549.
stem rust, cytological study, 45.
stem rust resistance, inheritance, 840.
straw, hydrolyzed, composition and feeding value, 166.
strawworm, control, U.S.D.A., 558.
stripe rust, investigations, Idaho, 746.
tests by State testing mill, 831.
tillage experiments, Wash.Col., 22b.

Wheat—Continued.
tillering, effect of extent of root systems, 530.
time of applying nitrate, Ky., 525.
toxic limit of alkali for, 513.
trade of United States, 795.
varietal resistance to disease and pH value of juice, 245.
varieties, Ga., 524; Nebr., 732.
varieties—
American, classification, U.S.D.A., 634.
better, need of, Ohio, 738.
descriptions, U.S.D.A., 825.
durum, U.S.D.A., 37.
Fusarium affecting, 840.
identification, 134.
in Tunis, growth periods and drought, 31.
resistant to Hessian fly, Kans., 453.
variety tests, 31, 135, 329; Kans., 427; Ky., 525; Pa., 223; Tex., 429; U.S.D.A., 825; Va., 134; Wyo., 429.
(*See also* Wheat, spring, *and* Wheat, winter.)
winter—
as affected by neutral phosphate, 517.
breeding experiments, Oreg., 525.
culture experiments, Mont., 129; Oreg., 525; S.Dak., 635.
effect of preceding kafir crop, 332.
important varieties, Nebr., 527.
plowing dates, U.S.D.A., 829.
producing after various crops, Wash.Col., 292.
progeny of speltoid mutation in, 335.
rotation experiments, S.Dak., 635.
seeding experiments, Idaho, 732; Mont., 129; Ohio, 733; U.S.D.A., 829.
varieties, Wis. 629.
variety tests, 232; Alaska, 426; Can., 734; Idaho, 732; Mont., 129, 130; Nebr., 733; Ohio, 733; Oreg., 525; S.Dak., 635; Wash.Col., 224.
yield, effect of crumb structure of soil, 210.
yields, Mont., 130.
winterkilling, effect of soil cultivation, Mont., 129.
with addition of minerals, nutritive value, Wash.Col., 265.
yellow berry in, Oreg., 541.
yields, effect of moisture supply during spike formation, 738.
Wheel slippage of tractors, data, 791.
Whey—
feeding value, 72.
production, composition and use, 782.
utilization, 312.
Whipworms, treatment, new method, 788.
White ants. (*See* Termites.)
White fish, insects as food for, 848.
White flies, control, 654.
White grubs, control, 50, 549.
White pine—
blister rust, control, 150.
blister rust in Michigan, Mich., 446.
blister rust, notes, 44.
early growth, N.H., 341.
production, 238.
stands, yield, effect of thinning, 42.
weevil, control, 761.
Wild fowl, North American, life histories, 756.
Willow, black, size of root cells and vein islets, relation to age, 424.
Willow canker disease, notes, 548.
Willow diseases in England and Wales, 645.
Willows as protection against drifting sand in drainage ditches, Mich., 439.
Wilting of plants, 521.
Wind pressure in chimney design, 388.
Windmill practice, modern, 688.
Windmill pumping, 586.
Winds, hot, in United States, 808.
Winter injury to apple roots, N.H., 327.
Wire or poverty grass, mechanical injury to livestock from, 679.
Wireworms—
control, 761.
false, on strawberry, Ark., 554.
false, studies, Idaho, 756.
Plains false, studies, Nebr., 658.
Wisconsin Station, notes, 99, 300, 498.
Wisconsin Station, report of director, 696.
Wisconsin University, notes, 99, 300, 498.
Wohlfahrtia vigil, nonhuman host records, 760.
Wojnowicia graminis, notes, Kans., 443.
Women, place in unified extension program, 492.
Women, training for extension work, 492.
Women, workers in beet fields, 796.
Wood—
ashes with cow manure, fertilizing value, 516.
conservation and improvement, treatise, 83.
destroying fungi, toxicity of zinc chlorid to, 447.
fibers, thermal conductivity, 186.
for fuel, source, 239.
kiln drying, U.S.D.A., 386.
moisture resistant coatings for, 385.
of Philippine dipterocarps, anatomical features and properties, 143.
poles supporting rural electric lines, creosoting, 485.
rot prevention experiments, Oreg., 539.
staining fungi, notes, 250.
used in aircraft construction, defects, U.S.D.A., 351.
water resistant end coatings for, 791.
(*See also* Lumber *and* Timber.)
Woodlands of Indiana, management, 341.

Woodlands, stratification and H-ion concentration of soils, 417.
Woods of forest of Analamazaotra, treatise, 440.
Woods of the world, bibliography, 440.
Woody plants, keys, 426.
Wool—
rôle in economic progress and international trade, 94.
trade in England, survey of growth, 191.
virgin and shoddy, differentiating, 412.
yield, effect of age and individuality, 871.
Woolly aphis. (*See* Aphis, woolly.)
World's—
Dairy Congress Association, 277.
Dairy Congress, editorial, 601.
Poultry Congress, announcement, 200.
Worm eggs, detection in animal feces, 785.
Wyoming Station, notes, 499.
Wyoming Station, report, 495.
Wyoming University, notes, 499.
Xenopharynx, genus, emendment, 499.
Xylocrius cribratus, notes, Oreg., 555.
Xylomiges sunia, control, V.I., 352.
Yams in Gulf region, culture, U.S.D.A., 738.
Yarns, tensile strength, effects of waterproofing and weather exposure, 386.
Yeast—
and yeast foam for pigs, Iowa, 774.
autolized, effect on growth of excised corn root tips in dark, 627.
bios requirement, 856.
growth-promoting substance, ultimate source of, 460.
laxative action, 459.
vitamin B content, 562.
Zinc—
arsenite, effect on foliage, 751.
chlorid, toxicity to wood destroying fungi, 447.
effect on growth of Aspergillus, 27.
in marine animals, 258.
oxid, insecticidal value, U.S.D.A., 449.
salts, effect on bacteriological analysis of water, 285.
sulphid, oxidation by microorganisms, 18.
Zirconium in Hagerstown soil, 617; Pa., 210.
Zootechny, specialized, treatise, 772, 782.
Zuntz-Geppert respiration apparatus, modification, 863.

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